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REPORT OF MISSION
TO PACIFIC THEATERS

31 JANUARY TO 30 JUNE 1944

- A. Japanese Defenses and Materiel
- B. Tactics and Equipment in Amphibious Operations
- C. Demonstration of New Weapons for Amphibious Operations

Prepared by W D Mission
for
The Chief of Staff

31 July 1944

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REPORT OF MISSIONS TO PACIFIC THEATERS,
31 January to 30 June 1944

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31 July 1944

MEMORANDUM REPORT FOR THE CHIEF OF STAFF:

Subject: Report of Operational and Demonstration Missions to Pacific Theaters, 31 January to 30 June 1944.

I OBJECTIVES OF THE MISSIONS.

The instructions of the group comprised two distinct, although inter-related, missions:

(a) To evaluate the suitability and effectiveness of Army-Navy weapons and ammunition and those of the enemy both during and following the operations in the Marshalls Islands; and to determine performance of standard materiel and requirements for new and improved weapons;

(b) To demonstrate new weapons and equipment suitable for beach assault and related operations in the Central, South and Southwest Pacific Theaters; to assist in determination of requirements for such materiel; and to disseminate in the theaters the information gained during the Marshalls operations.

II COMPOSITION OF GROUPS.

For the operational mission, the group consisted of Colonel C. H. M. Roberts, Ordnance Department, Lt. Colonel J. E. Walsh, Corps of Engineers, Major L. D. Frescoln, Chemical Warfare Service, and Captain D. R. Williams, Ordnance Department. For the demonstration mission, the group consisted of Colonel C. H. M. Roberts, Ordnance Department, Lt. Colonel J. E. Walsh, Corps of Engineers and Major H. S. Turner, Jr., Ordnance Department, with Major H. R. Bolster, Air Corps and Staff Sergeant K. W. Sohnrey, Air Corps attached for installation and demonstration of aircraft rockets. A complete itinerary of the trip and summary of activities are included as Appendices A and B.

III OPERATIONAL MISSION.A. General Discussion.

1. The group for this mission departed from Washington, D. C., proceeding by air to CPA headquarters and thence to Kwajalein for evaluation of the operations there; thence with the task force to Eniwetok to participate

in that operation and to evaluate its effects; thence to Tarawa for comparative study of the Japanese defenses at Betio Island. The group returned to Hawaii on 28 February and prepared its report, entitled MARSHALL ISLANDS: JAPANESE DEFENSES AND BATTLE DAMAGE, dated 1 March 1944. This report was submitted to and approved by the Commanding General, CPA and then forwarded to Washington. Major Frescoln and Captain Williams were detached from the group and returned to the States at that time. The Marshalls operations report should be considered as a part of this report.

2. In connection with the operational mission of this group in CPA, it is desired to express our appreciation of the courtesy, cooperation and assistance rendered by Navy personnel of all ranks with whom the group came in contact. This especially applies to Captain T. B. Hill, Gunnery Officer CINCPAC, whose enthusiastic cooperation and assistance contributed materially to success of the mission, and to Vice Admiral R. K. Turner, Commander Amphibious Force.

3. Following recommendations of OPD concerning the report of the Roberts Mission on the Marshalls operations, both CPA and SWPA are taking steps to constitute "damage analysis" teams to participate in and report on subsequent operations. Conferences were held with appropriate personnel in both theaters concerning the composition and functioning of such teams. Status of the team in SWPA is indicated by the letter from GHQ to USAFFE, dated 15 June 1944, included herewith as Appendix C. It is believed that, in addition to theater personnel, military specialists from the War Department should be included in such teams, to cover the more important operations. The purpose of this suggestion is to maintain somewhat closer contact with operations than would otherwise be possible and to facilitate acquisition of data of special interest to the Technical Services in connection with current field requirements and technical developments.

4. On radio instructions from the Chief of Staff, dated 1 April 1944, Colonel Roberts and Lt. Colonel Walsh, proceeded to GHQ, SWPA, arriving there 6 April 1944, and reported to General Sutherland, Chief of Staff, for the purpose of transmitting and discussing the Marshalls report. After

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conferences with General McArthur, General Sutherland, General Kenny, Admiral Kincaid and appropriate staff officers of GHQ, USAFFE and USASOS, the group was directed to proceed to New Guinea, for discussion of the Marshalls operations with the Seventh Fleet and Sixth Army. At Finschhaven, conferences were held with General Kreuger, General Patrick and appropriate officers of the staffs of Sixth Army, I Corps and 41st Division. The group then proceeded to the Admiralty Islands on 13 April for similar conferences with General Swift and officers of the 1st Cavalry Division. At the same time, the opportunity was taken to study the Japanese defenses and weapons at Lorengau and Los Negros Islands. From Los Negros, the group proceeded via Finschhaven to Cape Sudest, where a conference on amphibious operations, with particular reference to the pending Hollandia operation, was held with Admiral Fecheteler and Captain Noble. The group then proceeded to HQ, Sixth Division, Milne Bay for conferences with General Sibert, General Adler, General Hurdis and officers of the Division staff. From Milne Bay the group returned to HQ, USAFISPA at Noumea, arriving there 21 April. During the visit to SWPA, the opportunity was taken to make preliminary arrangements for the demonstrations to be given in that area.

5. To complete the operational mission of the group, information on the Marshalls operations was disseminated throughout CPA, SPA and SWPA. This was accomplished by exhibition of moving pictures taken during and after the operations, and by discussion of the operations with appropriate technical and line personnel of the Army, Navy and Marine Corps.

6. Subsequent to completion of the demonstrations, Colonel Roberts, Lt. Colonel Walsh and Major Turner, between 26 and 30 May visited Satelberg, Hollandia, Wakde Island and the Sarmi-Maffin Bay bridgehead to examine Japanese defenses in those areas.

B. Japanese Defenses in SWPA.

7. Conditions of warfare in SWPA are considerably different from the island operations of CPA. Since there are large land masses and much more territory to cover, fortifications are much less dense, it being obviously

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impossible for the Japanese to erect fortifications of the type encountered at Tarawa over such extended areas in entirely undeveloped country. Warfare tends toward patrolling activity after the initial landing operation. Formal defenses of trenches and log pillboxes are usually encountered only at bases and tactically important localities and, in general, Japanese defenses in SWPA were found to be much less extensive and more rudimentary than those in the Marshall Islands, although the log and coral bunkers in the New Guinea area sometimes present difficult tactical problems. The location, concealment and the nature of the jungle terrain make them difficult to discover and attack, while weather conditions add greatly to the burdens of combat. No concrete defensive installations were found in any of the areas visited, although fortified caves in the coral rock cliffs at Wakde were equally, if not more, formidable. A report of concrete defenses at Wakde Island was disproved by thorough examination of the installations there. No underwater obstacles or mines were encountered in any of these areas, although at Lorengau, in the Admiraltys, some beach obstacles and mines had been found. Fortunately, these were by-passed during the landings. Several hundred Japanese hemispherical mines were found in the Admiraltys but none of them had been installed, indicating the probability that the Japanese defenses were still not complete when the attack was made. Little use of mines or booby traps has so far been made by the Japanese. In the following paragraphs are given brief descriptions of the principal features of the defenses found in the areas visited in SWPA.

8. SATELBERG. At Satelberg the campaign had been fought along a narrow dirt road through thick jungle growth in rough precipitous country, where the ground rises from sea level to about 3200 feet in a distance of 9 miles. Slit trenches were the only defenses seen, although log bunkers were said to have been encountered, as well as 37 mm. anti-tank guns enfilading sections of the road. Tanks had been used to knock out these defenses and also to defeat the infantry positions. A typical view of the jungle in the Satelberg area is shown in Photo No. 1, taken from a former hilltop platoon

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defense area on the trail to Sattelberg. The operation had occurred some months previously and, as the photograph shows, the density of the vegetation made it difficult to locate defensive features and appraise their role in the operation. The nature of the terrain was such as to make it evident that it must have contributed to the difficulties encountered by the Australians at least as much as the Japanese resistance.

9. ADMIRALTY ISLANDS. In the Admiralty Islands, the Japanese defenses had been strongest at Lorengau, on Manus Island, and on the sea side of Los Negros. The defenses on Los Negros were, as in the Marshalls, confined practically to perimeter defense on the beach, particularly where there was dense jungle growth. However, at Lorengau there were about 370 log bunkers, of which some were on ridge lines hundreds of yards from the beach and others along trails leading into the jungle. These installations had been flanked by the American attack and had been destroyed by tanks, flame-throwers and hand-placed explosive charges. Inland defenses generally were confined to trails and avenues of advance from the beach. A few land mines had been placed on some of these trails, as well as numbers of the "Yard Stick Mines", which were first found in the Admiralties and which will be described in a later section. Along the beach at Lorengau Harbor, some wire was reported, together with the "Flying Pig", a new type of mine that will also be described later. Several hundred hemispherical antiboat mines were found in storage on the island, but none had been installed and there were no obstacles in the water. Several flame throwers of the usual cartridge-ignition type were found at Los Negros, (see Photo No. 2).

9a. On Los Negros, many shelters were built under the roots of huge trees and around fallen trees, this being especially true along the shore. See photos Nos. 3 and 4. The heaviest construction was about four thicknesses of 10" logs, mounded over with coral and earth. Coconuts had often been placed on top of the structures and had sprouted to afford natural camouflage. The Japanese use of natural cover and concealment was very good, although intergration of shelters and log pillboxes into the dense jungle and rain forest resulted

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in extremely squalid living, as evidenced by the conditions found. It is interesting to note that while the jungle is much denser than the palmetto growth at Fort Pierce, Florida, for example, the pine log pillboxes built for test purposes in the United States are structurally stronger than any seen at Los Negros or elsewhere in the Pacific.

9b. There was practically no evidence on the pillboxes examined at Los Negros of the effect of our weapons. Projectile impacts were not noticeable and almost no evidence of use of flame throwers and explosives was seen. Conversations with officers of the 1st Cavalry Division led to the belief that, except for the early phase, the action on Los Negros Island had been rapid pursuit through the jungle with the Japs not standing for defense, but seeking to escape to Manus Island. Shelters and pillboxes had been used for hideouts rather than defense works.

9c. The strongest installation seen was a series of about eight log bunkers along the shore of a cove on Los Negros, the interval between pillboxes being about 30 yards. This particular center of resistance had no depth, but had been sited to repel landing at a particularly favorable beach. The best of these pillboxes is shown in Photo No. 5. The cover is three layers of about 8 inch coconut logs and the improvised quality of the construction is apparent in the photograph.

9d. Two typical examples of Japanese trench systems are shown in Photos Nos. 6 and 7. The trenches were shallow (about 30 inches deep), unrevetted, and of zig zag trace. However, most of the terrain was thick jungle where both sides had the advantage of concealment, and the difficulty of making progress through the jungle was more of an obstacle than the intermittent trenches and pillboxes.

9e. The Japs had a number of anti-boat guns of 4.724" caliber emplaced in earth and coral open gun pits of 25 ft. diameter along the sea side of Los Negros Island, as shown in Photos Nos. 8 and 9. These guns were near the airstrip and had not been badly damaged by Naval gun fire or bombing. In fact, it was said that one of these guns had been used by our own troops after

the landing. They were painted green and had gun shields of 3/16" to 1/4" steel. They could be elevated only between -7° and $+33^{\circ}$, and thus were not dual-purpose, but solely anti-boat guns. These guns were complemented by a searchlight installation, the mirror of which was of about 48 inches diameter. Although it would usually be presumed that a searchlight would be primarily for anti-aircraft defense, its location near the anti-boat guns on the shoreline indicates that it complemented these guns for use in repelling landing craft. Furthermore, it was located under trees along the shore, which allowed use seaward but interfered with use against planes. See Photo No. 10.

9f. The airfield on Los Negros was the most elaborate Japanese field seen in SWPA, having an excellent landing strip, with a large dispersal area and numerous log and earthen plane revetments. The field was in active use and the runway was being further extended, as shown in Photo No. 11.

10. WAKDE ISLAND. On Wakde Island the defenses had been reported to be the strongest yet met in the American drive up the northwest coast of New Guinea. It was therefore examined rather carefully and completely. Log shelters and pillboxes had existed, but, as at Los Negros, not in any great number, being auxiliary to the main defense from trenches, foxholes and from concealment and natural cover. Wakde had been an operating air base for the Japs, as it has become for us, and the most extensive construction had been the air field and plane revetments, of which there were perhaps 25 scattered about the edges of the field. Photo No. 12 shows the usual type of earthen mound construction, but there were two revetments of more advanced type. These were being used by our troops for bomb storage, as illustrated in Photo No. 13. The revetments were approximately 10 feet high and enclosed an area about 50 by 75 feet. The air strip had been quickly restored to full operation, an excellent rehabilitation job having been done by the Engineers, and the original runway of about 5000 feet length was being further extended to the ends of the island.

10a. Most of the coconut log structures were passive in nature, air raid shelters predominating over pillboxes with firing apertures. The strongest shelter observed is shown in Photo No. 14. Cover was afforded by three 12-inch

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logs mounded over with earth and vegetation. Another shelter with cover of only one layer of 10-inch coconut logs is shown in Photo No. 15. This photograph shows how difficult Jap pillboxes and shelters can be to locate, because of the natural vegetation which so easily and so quickly conceals them in the jungle.

10b. Very little damage from gunfire was noticeable on Wakde Island log shelters, because of their limited number and lack of evidence on the few shelters undisturbed by cleanup activities. The village area on Wakde had been completely destroyed by 105 mm. artillery fire from the neighboring mainland and a nearby island, where landings had been previously made. Photo No. 16 shows debris of the village site and indicates the flimsy type of construction, of light lumber and corrugated metal roofing. The effects of our shelling also can be seen in Photos Nos. 17 and 18 which show the effect on the foliage of tree-bursts of high-explosive rounds. The plane shown in Photo 18 is one of many which had been destroyed on the ground by bombardment, probably from the air.

10c. A double septic tank had been drained and used for ammunition storage. It and one other similar structure must have formed the basis for reports of concrete defense works, as no other type of concrete structure was found on the island. This tank is shown in Photo No. 19. The laminated construction is apparent, the concrete being of extremely poor quality with compressive strength estimated to be less than 1500 lbs. per sq. in. The 24-inch walls were judged to be easily penetrable by 37 mm AP projectiles. It is possible that riflemen or machine gunners may have used this shelter during the fighting, but it definitely was not a defensive structure.

10d. The north coast of Wakde Island was honeycombed with caves in the coral rock cliffs which existed there, the nature of the formation being shown in Photo No. 20. Many of these recesses were barricaded by logs or earth-filled 55 gallon drums and thus converted into pillboxes. Fortunately the assault was delivered on the opposite side of the island, so that these formidable defenses did not have to be reduced before the landing was effected.

In this area also, there was seen again the Jap sniper-post constructed of a gas-drum recessed into the earth, as shown in Photo No. 21.

10e. Throughout the island, well dispersed dumps contained plentiful supplies of gasoline and ammunition, some of which had not been damaged by the bombardment. A few 75 mm field guns were seen, and one AA position consisting of a multi-gun airplane turret built into a beach pillbox. Most of the Japanese ordnance, however, had been removed prior to our visit. No beach or underwater obstacles or mines were reported and very limited use of barbed wire was noted.

11. SARMI-MAFFIN BAY AREA: A short visit was made to the area of the original landing on the New Guinea mainland, opposite Wakde Island. The operation still was in its initial stages and the beach head was only a few hundred yards wide and ten or fifteen miles long. There was little evidence of formal defensive installations, other than a few small bunkers and rudimentary trenches along the beach. Along the perimeter, the action on both sides was being conducted from foxholes and improvised shelters and frequent infiltration raids occurred, especially at night.

12. HOLLANDIA: At Hollandia, which had been a major Japanese base, very little evidence of defensive installations was noted. The campaign had been one of movement and use of natural jungle concealment and cover, rather than assault of a fortified position. Some slit trenches and a few air-raid shelters, of the same coconut-log type as noted at Wakde and Los Negros, were seen in the vicinity of camps and workshops. The Japanese had well-dispersed bomb storage, as they have everywhere, along dirt roads in the woods both at Wakde and Hollandia. They had excellent machine shop equipment as well, also dispersed through the jungle near trails and roads. Some of this equipment had been repaired and was being used in the 24th Division Ordnance Shop, including an excellent six inch lathe and a gasoline generator that was being used for welding and lighting. The Japs had attempted to destroy their shop equipment, but those efforts had been feeble, erratic and poorly directed. A considerable number of Japanese trucks and cars were seen, many of which

had been repaired and were in use, as well as one medium tractor which was being used on road repair work. This tractor was equipped for attachment of a dozer blade, but it was not seen. Large numbers of Japanese truck and airplane tires were seen.

12a. It had originally been feared that the harbor at Humboldt Bay would be mined, but this proved to be not the case. At neither Humboldt Bay nor Tanahmerah were any underwater or beach mines or obstacles encountered, and Japanese resistance to the landings had been weak. The chief obstacles in the operation had been poor beach areas, swamps, and bad roads, which after thirty days still restricted operations and necessitated bringing gasoline to the fields by air. The offensive operation had quickly degenerated into patrol action, which was proceeding vigorously in the surrounding mountainous areas where the Japs had taken refuge.

12b. The three airfields between Hollandia and Tanahmerah had been taken early in the attack and had been quickly restored to full operating condition, despite the fact that they had previously been bombed continuously for some time. It was reported that 200-300 Japanese planes had been destroyed on these fields, and numerous wrecks were seen in the vicinity.

12c. No Japanese air opposition was reported during the Hollandia attack, although subsequently a single night raider destroyed considerable ammunition and supplies on the crowded beach at Humboldt Bay. Sporadic night raids occurred from time to time but few bombs were dropped. Further demonstration of our air supremacy and the degree to which Japanese defenses were being neutralized was afforded by the fact that our group twice flew past Wewak in transport planes, without drawing AA fire. On the second flight, a heavy bombing raid on the airfields and depot areas of Wewak was observed, without evidence of retaliatory fire.

C. Amphibious Operations: Tactics and Equipment.

13. While nothing comparable to the beach and underwater mines and obstacles encountered at Tarawa (See Photo No. 22) have been found elsewhere, it appears inevitable that such obstacles will be encountered in operations

nearer to Japan. Therefore, it is essential that work be continued and accelerated in the development of equipment and techniques for overcoming such obstacles. The present status of these developments indicates that the only 100% reliable methods involve the placing of demolition charges by hand by men in the water, working under cover of concentrated air and naval bombardment. This method is slow and costly and involves the sacrifice of tactical surprise. Following the action at Tarawa, the Navy installed an underwater demolition station at Oahu, where methods of combatting Japanese obstacles were investigated and teams were trained for the Marshalls operations. This station has recently been expanded and transferred to Maui. In view of the fact that all Pacific operations are amphibious, because of the unique conditions in those areas, and since the amphibious phases of European operations are now of secondary importance, it is felt that serious consideration should be given to concentrating the work on underwater obstacles at Maui. The stations at Fort Pierce should be continued in operation but should concentrate chiefly on development of new equipment, while the Maui station should concentrate chiefly on development of methods of use and on training of teams for operations. It is believed that the activities of the Joint Army-Navy Board on beach and underwater obstacles could profitably be transferred to Hawaii, and that this board should be fully cognizant of the current status of all developments, both in methods and materiel and in operational experience and practice. A more comprehensive discussion of the passage of beach and underwater obstacles is contained in Appendix D.

14. In combatting underwater obstacles, especially mines such as the Japanese hemispherical mine, a primary difficulty is that of locating them. At present this can be done only by men in the water, either wading or swimming under water. Tests were made with the standard SCR-625 mine detector but it was not designed for such use and its limited range, inadequate waterproofing and difficulty of operation make it unsuitable for the purpose. There appears to be definite need for a detector for submerged mines, which should be waterproof and suitable for operation by men in waist or chest depth rough water and which should have a horizontal range of at

least ten feet. Such a detector must be sufficiently light to be carried by one man, in addition to the explosives required to destroy mines and obstacles. Division 6, NDRC now has under test a device known as "USDAR 500", manufactured by RCA, which may be suitable for the purpose. This detector weighs six pounds submerged, and can detect underwater objects at distances of 30 feet or more. Disadvantages are that it will respond to any underwater discontinuity, such as a coral head, and may not detect buried objects, such as sand covered mines. However, development of this detector should be expedited, as it may provide a solution to this requirement. Concurrent development of a detector specifically adapted to underwater metallic mines is also recommended.

15. In CPA, the Commanding General, on 3 February, appointed a board of officers, headed by General Kernan, to follow up the recommendations made by the Borden Mission in their report dated 12 January 1944, concerning development of increased fire power in amphibious operations. Text of the order appointing the board and defining its mission is shown in Appendix E.

16. In CPA, as a result of conferences between Captain T. B. Hill, CINCPAC Gunnery, Colonel Roberts, Colonel Unmacht, Major Frescoln, and CPA staff officers, experiments were made in equipping an LCT with four 4.2" chemical mortars, (See Photo No. 23). This support boat was fired during the new weapons demonstration in Honolulu on 29 March, placing 100 rounds in a 400 yard area on the beach in 1 minute 15 seconds, from a range of 1500 yards. It was so successful that three LCT's were equipped with eight 4.2" mortars each, for use in the Saipan operation. Unfortunately, one of these LCT's was sunk in a launching accident, while the other two were destroyed in a serious fire and explosion at Pearl Harbor in late May. It is planned to equip additional LCT's with 4.2" mortars for subsequent operations, as results of the tests indicated that they can be used with great effect in affording close support to the assault waves while approaching the beach. The design of the installation is such that the mortars can be quickly removed for continued use ashore, after the beach-head has been secured, while the LCT can revert to normal

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usage in landing supplies and materiel. In view of this additional prospective use of the 4.2" mortar and because of its demonstrated effectiveness as a close support weapon, it is to be anticipated that additional demands will be made by the Pacific Theaters.

17. In SWPA, General Heavey, 2d Engineer Special Brigade, was much interested in the use of 4.2" mortars in landing craft. Since LCT's are not available there for such use, it was suggested that they could be fired effectively from LCM's, for which the CWS mortar mounts LC-E2R2 have been developed. A special requisition for four of these mounts was submitted under date of 24 June 1944, to facilitate operational tests.

18. Additional improvisation of standard weapons for firing from landing craft has been done by the Second ESB, as described by General Heavey at a conference in Brisbane early in June. LCM's have been equipped with two Mk VIII Navy rocket launchers (12 round-3x4) in the bow, four twin .50 cal. aircraft turrets amidships, and two 20 mm guns and one 37 mm aircraft automatic gun on the stern. Such an LCM has a crew of six men, who fire the various weapons at appropriate air or ground targets. A modification of this installation consists of substituting an M4 aircraft 75 mm gun for the rocket launchers, the gun being mounted in the bow and firing through a hole cut in the ramp. It was not understood whether these support boats were in the development stage or had already been used in operations. General Heavey said that effectiveness of rocket fire from LCM's of the 2d ESB had been much improved by use of a simple range finder, details of which were not obtained.

19. In the development of fire power to cover and support amphibious assaults, one of the most important and least developed phases is during the last 500-1000 yards of approach to the beach. During this period it is necessary to raise the flat trajectory naval fire support, to avoid casualties in the assault waves, and to terminate the air bombing and strafing. During this interval, the principal close support is afforded by firing rockets and minor caliber weapons from support boats and landing craft. This interval of comparative calm is utilized by the enemy to reorganize his

defenses and prepare to resist the landing with every weapon that can be brought to bear. It would contribute materially to morale of the troops and would further demoralize the defense, if the assault waves were capable of maintaining continuous barrage fire with heavy weapons, up to the instant of landing. This result can be attained by utilization of standard organic heavy weapons, including mortars, tanks and artillery, during the approach to the beach, rather than using the landing craft merely as transporters of dead freight. Considerable development work along this line has been carried out at Aberdeen Proving Ground, following the Borden Mission to CPA in January, has been covered by reports distributed to the theaters and has been supplemented by certain developments in the theaters. An objection to such utilization of weapons has been their reduced accuracy when fired from the unstable bases afforded by landing craft. The objection is valid, but can be minimized by training, as has been proved by experience of the 27th Division. Furthermore, it does not take account of the fact that what is needed primarily is barrage fire, rather than fire against point targets, and that whatever it may lack in pinpoint accuracy is more than compensated by its volume and demoralizing effect on the enemy. This use of standard weapons need in no way detract from their subsequent fire power and use ashore, because the ammunition used can be carried in the boats in addition to their organic complement and the mounting expedients (if any) required for firing from the boats will be such as to be capable of expeditious removal on arrival at the shore. The proposals, in brief, envisage the dual use, i.e., afloat and ashore, of standard weapons, rather than their present single-purpose use ashore. The Navy 4.5" barrage rocket has been used more or less extensively to support landing operations, but further utilization is feasible and desirable. It is recommended that all organizations likely to be engaged in amphibious operations should receive intensive training in firing their organic heavy weapons from landing craft.

20. Further to improve the accuracy of fire of artillery, rockets, mortars and other weapons from landing craft, it is believed desirable and

feasible to develop a small gyro-stabilized firing control, which would be provided with electrical contacts to permit firing the weapon only within certain predetermined limits of pitch and roll of the craft. Such a device should be especially useful and feasible for insertion in the circuit of electrically fired weapons, such as rockets, which at present are without fire control or sighting equipment. It is especially desirable to provide a simple, preferably hand-held, sight for range determination when firing weapons from landing craft. This is important because of the difficulty of judging distances over water, especially from small boats. In firing the 4.2" mortar from the LCT, successful use was made of the meter base coincidence range finder, but a smaller device is needed. Extreme accuracy and long range are not required, a total range of 2000-3000 yards, with an accuracy of 1-2%, being adequate for the purpose.

21. In comparing operational procedures in CPA and SWPA, a marked difference in use of LCI's was noted. In SWPA, these craft are used in their original role as infantry landing craft. In CPA, the LCI is used exclusively as an assault support boat. For that purpose its armament has been greatly increased, consisting of seven or eight 12 round Navy rocket Launchers, two 20 mm. guns, three 40 mm guns, five .50 cal. machine guns, and a number of .30 cal. machine guns. At Kwajalein and Eniwetok, these support LCI's went in with the first wave, there being three on each flank. At about 1000 yards, all rockets were fired in ripple salvos, after which the LCI's circled outward on each flank, raking the beach with all weapons that could be brought to bear as they turned.

22. The vital elements in the overall picture of amphibious operations in the Pacific are:

(1) acquisition of accurate and complete photo-intelligence and its proper interpretation and use in preparation of the plans for the operation;

(2) the initial "softening up" by protracted air and naval bombardment;

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- (3) the concentrated final preparation by air and naval bombardment;
- (4) the removal of beach and underwater obstacles, if any exist, under cover of the naval bombardment;
- (5) augmentation of the assault preparation, when possible, by the extremely important and powerful high angle shore-based artillery;
- (6) the assault proper, with its integral barrage support as recommended above; and
- (7) the post-landing phase of the assault.

Of the above elements of an operation, those which appear to require further development and improvement are items (1), (4), (5), and (6), with the last being perhaps the one most in need of immediate improvement because of the vulnerability of the troops during this phase of the operation.

23. The war in the Pacific has accentuated the construction activities of the Engineer Corps, where the long distances and use of air and water transport require rapid construction of air fields, port facilities and depot installations. Engineer functions are threefold: Construction, Supply, and Combat; and are important in that order. It is felt that concentration of effort should stress these subjects in that order, whereas actually the two most important, construction and supply, have been subordinated to combat engineering in the schools and training centers of the continental U. S. Even divisional engineer battalions are most often employed on construction work; roads, bridges, and water supply being their main activities. Engineers could have been used more often in a combat role, but the more prosaic requirements have to a great extent prohibited this. The Engineers have done an excellent job on construction and combat work, and the difficult supply situation is being gradually improved. As an indication of the important role of Engineer troops in the Southwest Pacific, some data on the Hollandia operation are illuminating. Of the Combat troops 19% were engineers; of the Service troops 76% were Engineers. There were 24,626 Engineer troops

in the total of 60,289 men engaged, or 41%. The proportion of engineers is unusually high, but is a reflection of the necessity for road and air-field construction in the undeveloped country of New Guinea, a primary objective of the landing being the early operation of airfields.

24. Assault technique, for which Engineers as well as Infantry are often employed, has tended in operations in the Pacific toward use of explosive charges and flamethrowers in the mopping-up stages of an advance. Tanks and infantry advance against hostile positions, while Engineers and infantry employ explosive charges and flamethrowers to clean out by-passed shelters and pillboxes in which Jap defenders have taken cover. It is felt that such use of explosives and flamethrowers is natural and effective, and should be introduced as the basis of training in these weapons.

25. Engineer troops have in all theaters been called upon to dispose of duds. Their responsibilities for anti-tank mines and booby traps and training in use of explosives gives them a fair background for such work. SWPA has been training Engineers in dud-disposal for two years, while CPA has recently initiated similar training. Such training should be given in the continental United States, where it could be introduced as part of the work on mines and booby traps. This work should be limited to demolition in situ of duds. Where an unexploded bomb has to be neutralized or moved, the work should continue to be done by Ordnance Bomb Disposal Units, whose special training qualifies them for such work. A separate letter recommending incorporation of training in dud-disposal into the present training on mines and booby traps has been sent to the Chief of Engineers, (See Appendix F).

26. Generally there are too few Engineer supply and service troops in the theaters. Supply depot units, for instance, must utilize labor of prisoners and casual troops to augment their inadequate strength. It is necessary to set up adequate service units which are self-sufficient and independent. There is a tendency to underman Engineer service and supply agencies. It is realized that theaters must balance their personnel requirements, but for planning unit activation, there is a greater need for

Engineer service troops than for combat or construction battalions.

27. Engineer specialists, such as welders, equipment operators, etc, should be given training with commercial firms in the States; e.g. welders in the big shipyards. Courses of 2 to 4 weeks duration, of an almost exclusively practical nature, would be adequate. Men in the 2d Engineer Special Brigade were so trained for a two week period at the Kaiser shipyards in San Francisco. It is recommended that similar training be given all welding specialists. The Engineer of a theater receiving such trained replacements must be informed of their coming, so that they may reach the proper organization, otherwise the training given has been wasted.

D. Technical Intelligence and Japanese Materiel.

28. In SPA and especially in SWPA the Ordnance Intelligence teams have been performing outstanding work in collection, examination and forwarding to the States of samples of enemy material. In CPA, Ordnance personnel allocated to this work have been limited and had not participated in any of the operations up to 1 June. Obviously if the most effective results are to be obtained, Intelligence teams should participate in the operations, in order to recover material before it has become damaged, destroyed, or carried away by souvenir hunters. In SWPA, Ordnance Intelligence personnel have participated in all of the landing operations and have secured much valuable materiel. In addition, their services have been effectively utilized by organization commanders in furnishing to the troops information on the characteristics and use of enemy weapons. The efforts of the Intelligence teams have been hampered by lack of adequate equipment and trained personnel, and morale has suffered to some extent due to slowness in promotions. Adequate T/O and E's should be provided for these intelligence teams in order to legitimize their activities. As is being done in SWPA, at least, steps should be taken to accelerate formation of joint intelligence teams, comprising representatives of all of the Technical Services, in order that the same character of service now being rendered in the Ordnance field may be extended to them.

29. From Ordnance and Naval Intelligence personnel in the Admiralty and from observations at Hollandia and elsewhere, information on a number of

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new Japanese items was obtained. While these items have probably been reported through Intelligence channels, they are discussed here because of their relation to the missions of this group.

30. Japanese "Yard Stick" Mine. This mine consists of an oval sheet metal tube approximately 3 feet long by $3\frac{1}{4}$ " wide and $1\frac{5}{8}$ " high, with detachable end caps. It is loaded with four pairs of approximately one pound shaped blocks of picric acid explosive (Jap No. 170), giving a total charge of about 8 lbs., equivalent to our Bangalore Torpedo. Adjacent faces of the pairs of explosive blocks contain cavities into which are fitted special pressure firing devices, there being four such devices per mine. The firing device consists of a spring-loaded firing pin assembled transversely to the body of the device and adapted to function a detonator and booster when a shear wire is broken by pressure and the restraining plunger pushed down. A pressure of approximately 350 p.s.i. is required to cause functioning of the firing device, although when the shear wire is removed it will function on about 6 p.s.i. Several sizes of shear wire were found, indicating that the mine can be assembled for several degrees of sensitivity between these limits. When assembled in the mine, all firing devices have the pressure plate uppermost, with a long safety wire passing through the plungers of the firing devices and protruding from one end cap. The mine is functioned by crushing of the body, thereby transmitting pressure to the firing devices. Details of the "Yard Stick Mine" and its firing device are shown in Photo No. 24 and Fig. 1. Firing devices for this mine were found at Kwajalein by Lt. Campbell, Ordnance Bomb Disposal officer, but no other components were observed and the use of the firing device could not be determined because it has no threads or fittings to permit its attachment to other metal components. The complete mine was first found by personnel of the 8th Engineer Sqdn., First Cavalry Division, on Manus Island, where it was emplaced in trails and other avenues of advance likely to be traversed by tanks or vehicles. It was usually placed, in conjunction with the standard six pound "tape measure" mine, in straight rows across the trails, being intended to function on passage of men or vehicles. No complicated or formal mine field patterns were reported.

31. "Flying Pig" Mine. A second type of Japanese mine was also

found for the first time in the Admiraltys, having been installed as a controlled mine, in connection with double apron barbed wire fences at Lorengau Harbor, on Manus Island. While there were some conflicting statements as to the use of this mine both underwater and on the beach, best information indicates that it was used only on the beach, where it was emplaced at about 50 foot intervals under the barbed wire fence. The "flying pig" consists of a sheet steel (approximately 1/4" thick) cylinder about 8" diameter and 10" long with domed ends. At each end is a sheet metal yoke with an eye, intended for attachment of a towing cable. Near the ends of the cylindrical sides are two pairs of bar steel arms about 7" long, which project from the body at an angle of about 20°. See Photo No. 25. The mine is fired electrically by means of a detonator inserted in the side of the container and connected to a suitable length of heavily insulated double conductor cable. Total weight of the mine is about 30 pounds, including a charge of about 19 pounds of a black crystalline explosive. Analysis of this explosive by the Navy Mobile Explosive Investigation Unit indicated the composition to be 75.5% ammonium perchlorate, 14.6% silicon carbide, 5.9% wood pulp and 3.9% heavy oil. According to translation of Japanese data, the explosive is known as T-88. Use of the "flying pig" as a remotely controlled mine in connection with wire obstacles at Manus was apparently an improvisation, since information obtained from M.E.I.U. indicates that the mine was designed for use in destruction of submarine mines, being towed from a minesweeper by a length of cable attached to the towing eyes. The projecting arms are intended to engage the anchor cable of the mine and permit the "flying pig" to be drawn into contact with it, whereupon it is fired electrically from the sweeper.

32. At Los Negros, Japanese small arms ammunition with wooden bullets was found. Such ammunition, identical with service ammunition except for the wooden bullet, has been reported from other Pacific Theaters and both the Germans and Italians are known to have similar ammunition. It was rumored that Japanese infiltration raiders use this ammunition, but this seems unlikely as tests have shown that its effective range is less than 25 feet. Consistent

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with German and Italian use, this ammunition is apparently employed only for launching rifle grenades.

33. On Los Negros Island, two types of Japanese water purification units were seen and it was requested that they be forwarded to the Engineer Board at Ft. Belvoir. Both units resembled the new pack-type diatomaceous silica filter units in that they comprised filter cylinders of stoneware. However, no filter-aid material was seen, nor any way of introducing it into the equipment. The small purification unit consisted of one filter cylinder, fed by a hand operated pump similar to a bicycle pump, weighed about 20 pounds, and is shown in Photo No. 26. It would supply purified water for possibly one platoon. The large size purification set, shown in Photos Nos. 27, 28 and 29, consists of two units and was estimated to weigh over 100 pounds. This purification set should be adequate to supply a company. One unit consists of a box containing two hand-operated pumps, water heaters, filter cartridges and miscellaneous accessories. The other unit consists of a six-element filter housed in a drum and provided with a rotary brush for cleaning the filter cylinders. The cover of this unit is detachable and may be used as a surge tank for chlorination or addition of treating chemicals.

34. A Japanese reproduction unit of the silk screen type was found on Heartstrings Island at Eniwetok and is shown in Photo No. 30. While not complete and in badly damaged condition, it appeared to be similar in type to the new Engineer sign reproduction set.

35. Among Japanese automotive equipment captured in New Guinea, some items of interest were seen, including a jeep somewhat similar to our own vehicle. Headlights of trucks are provided with external adjustable blackout shutters, which can be adjusted to control the amount and direction of the beam. Many trucks were provided with built-in tools boxes opening both into and outside the truck body, to improve accessibility of the contents. This feature is similar to ideas incorporated into Engineer Squad trucks in the field about 1940.

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36. An amusingly impertinent piece of Japanese psychological warfare literature has been used in New Guinea, consisting of a "Surrender pass" that was being dropped from Japanese planes, and is reproduced in Photos. Nos. 31 and 32. On one side is a happy family picture, while on the other are printed instructions for surrendering. Instructions in Japanese state that the bearer of the card has surrendered and is to be given protection.

IV MATERIEL: PERFORMANCE AND REQUIREMENTS.A. General Discussion.

1. In general, the performance of standard materiel under the severe conditions of tropical jungle and amphibious operations is excellent, as well as the confidence of the troops in their weapons. In a few places, notably at Guadalcanal, Ordnance storage conditions are especially bad but are currently being improved, largely as the result of General Reiml's efforts there. As reported previously, the M51A1 artillery fuze, even after having been drop-tested as prescribed, has resulted in prematures in 155 mm howitzers. Current action to replace this fuze with the M51A3 fuze should be accelerated and all M51A1 fuzes withdrawn from issue as soon as possible. Considerable difficulty is being experienced with erratic ranges and dispersion of 105 mm ammunition and with mixing of ammunition lots. This subject was discussed at length with Ordnance and Artillery officers of many organizations. Present plans of the Ordnance Department to grade and classify 105 mm ammunition to minimize these defects should be completed as soon as possible, and the necessary technical personnel and equipment should be sent to the Pacific theaters at an early date. Although waterproof increments for mortar ammunition have been sent to the theaters, they appear not to have reached the troops, as numerous requests for such increments were heard. In several places, mortar ammunition obtained from local stocks for demonstration purposes was found to be in unserviceable condition due to rust and damp increments, further emphasizing the importance of expeditious completion of the project for waterproof ammunition containers. Serious difficulties are still being encountered with shorts and erratic rounds in 60 mm mortar ammunition. This condition warrants serious consideration of the proposal made elsewhere in this report that the 60 mm mortar be replaced with the short 81 mm mortar.

2. Throughout SWPA many favorable comments were heard about the Borden "Jungle Warfare Mission", which was credited with increasing the morale and the confidence of troops in standard weapons and in proving the feasibility

of use of tanks, etc., under jungle conditions. The Medium Tank M4 is becoming one of the most important weapons for use against the Japanese. Used as an Infantry assault weapon, it is one of the best "bunker busters" found so far. Although better flotation would be desirable, the present relatively high ground pressure does not preclude use of the medium tank in the jungle.

3. Comments on a few of the "jungle warfare" items appear to be pertinent. Armored cabs for bulldozers have been received, and it was understood that they are to be installed soon. Data on protective qualities of the cab plate are urgently desired by the theaters. In response to a radio inquiry from the War Department, an effort was made to obtain operational data on skid pans for artillery. These skid pans have not been used, but SWPA is constructing several sets of the skis recommended by the Field Artillery Board and expects to conduct comparative field tests within about a month (this information as of 15 June). A report on the tests will be forwarded to the War Department through G-3, USAFFE.

4. In preparing task forces for combat operations, an enormous amount of work is performed in preparing and loading ammunition pallets. Consideration should be given to the palletizing of ammunition for shipment overseas, which will facilitate handling at the ports, will decrease time required for loading and unloading ships, will tend to minimize the dispersion and mixing of ammunition lots during handling and storage, will automatically provide dunnage for field storage, and will insure receipt of ammunition in the form most suitable for amphibious operations. Similarly, palletization of certain quartermaster or engineer items may also be advantageous.

5. In view of the heavy demands made upon Engineer construction units in the early stages of occupation and development of new areas, it appears highly desirable that T/E's of Ordnance depot and ammunition companies be modified to provide construction equipment suitable for building and maintaining roads to and in their areas. Similarly, these organizations should

be provided with sufficient shop equipment and supplies to enable them to do the packing and boxing of equipment, supplies, ammunition, etc., required for repairing damaged shipments and for preparing materiel for issue to task forces and other units.

6. In SWPA, the Ordnance Officer XI Corps recommended that Ordnance Shops, especially those doing renovation of automotive parts, be provided with supplies for standard packaging, thus facilitating their return to stock and insuring their receipt at destination in serviceable condition. This recommendation was transmitted to the Ordnance Officer, USASOS, who will investigate its feasibility and the availability in Australia of materials for implementing this proposal.

7. In SWPA, the need was expressed for means for improving the availability of spare parts and heavy equipment repair facilities immediately after completion of amphibious operations. It was suggested that this might be accomplished by equipment of landing craft, e.g., LCT'S and LST's, as floating shops and depots. Such craft would be included in the task force and would be able to start functioning immediately after a beachhead is secured. Besides increasing the efficiency of use of vehicles and equipment landed for the operation, it would minimize the quantity of such equipment deadlined for repairs and parts, and would eliminate present delays incident to construction of shore based facilities. Similar floating shops for Ordnance and other intelligence units, providing facilities and equipment for collection, preliminary examination, storage and preparation for shipment of captured enemy materiel would greatly facilitate operation of those units.

8. Technical reports, such as Ordnance reports on firings of artillery from landing craft, effects of bombs and artillery on resistant targets, etc., now being sent to the theaters, are very favorably received and the data provided are of material value. The theaters desire additional reports of the same type from all the Technical Services. Data on terminal ballistics and effectiveness of ammunition of all kinds, and data on new material, especially when its development is nearing completion, are particu-

larly wanted. For all newly standardized and limited procurement items, they desire timely summaries of their characteristics and performance, in order to afford a basis for determination of requirements for such materiel. Publication of the monthly information circular on new items by the Supply Section, Office Chief of Engineers, should be resumed. These technical reports and summaries should be supplied to the theaters in sufficient quantity to permit distribution to technical officers of divisions and supply services, the Army Air Forces and G-3's and G-4's of divisions.

9. To investigate Australian engineer materiel, a visit was made to their School of Military Engineering. A complete report of this visit is included as Appendix G, to which reference is made as it discusses a number of items of present or potential interest to the Corps of Engineers.

B. Engineer Materiel.

10. Engineer Special Brigades in SWPA have been used variously. The 2nd ESB has been handling most of the operational landings, in conjunction with the Navy; while the 3rd ESB has been used for resupply missions, employing their craft for movement of supplies to forward installations. The 4th ESB is new in the theater and its mission has not been defined. The greatest materiel problem of the Brigades is the necessity for replacing propellers and propeller shafts of landing craft, which are bent and broken at rates up to 3 or 4 assemblies per boat per month. The Brigades have experimented with a squirrel cage guard for the propeller assembly of LCM's, to reduce this excessive replacement and maintenance problem. Their improvisations have not been completely successful, but have shown enough promise to lead them to believe that such a guard can be developed. This development would contribute materially to solution of the problem of adequate boat maintenance. It is understood that the need for this item has been referred to the Navy, which is responsible for procurement of landing craft. It is recommended that immediate action be taken to develop and supply a guard for propeller assemblies of present types of landing craft.

11. Engineer Special Brigades have indicated a need for inside mounted dozer blades of 100-inch width to allow transportation of D7 bull-

dozers in LCM's. They have requisitioned these items, whose supply is being separately processed. This item is a part of the beach attachment set for D7 Tractors, whose other components are an A-frame and a rear-mounted double-drum winch. The crane is not wanted in SWPA, because it is preferred to utilize A-frames on DUKW's, thereby releasing bulldozers for use in their primary construction role.

12. It was noted during operations and learned from officers in SWPA that there is a need for standard timber ramps or bridging of short span to allow unloading of vehicles from LST's. The method used at Hollandia was the dozing-up of earth fill at the landing point of each LST, which diverted the services of bulldozers urgently required for other work. A simple design of timber or steel ramp, adaptable to various slopes of beach, should be provided.

13. In SWPA, it was reported that the Bailey Bridge has too narrow a roadway to allow the passage of a D-8 Tractor with dozer blade. Discussion of this problem with officers at the Engineer School developed the fact that by angling the blade such a tractor can cross the Bailey bridge. This information should be furnished to theaters and efforts made to devise improved means for accommodating wide vehicles on present bridging equipment. In muddy conditions vehicles frequently skid and bump into the steel girders of Bailey bridges, this occurring particularly at the entrance to bridge spans. In SWPA a center guard rail has been improvised to correct this condition, but has not been an adequate solution. It is recommended that the Engineer Board work out the best placement of guard rails to remedy this situation.

14. There is need for a simple suspension footbridge to span deep, narrow ravines. This is a deficiency in bridging equipment which can at present only be filled by field improvisation. In SWPA, Australian ARC mesh landing mat has been used for improvised foot and light vehicle bridges. Recent reports from NATO have told of similar use of our pierced-plank landing mat. It is recommended that the Engineer Board initiate development of a simple suspension footbridge of about 150 feet maximum span.

15. In theater supply depots there are stocked various sizes of blasting caps. The Engineer Special blasting cap is universally applicable for military demolitions. The existence of No. 8 and No. 6 caps in depots complicates supply. The caps inevitably get mixed up and failures occur in demolition work. For example, in SPA a failure to detonate an M2 Tetrytol block occurred when using what was supposed to be a No. 8 cap. This matter was discussed with the demolition section of the Engineer Board which is in accord with the recommendation that Engineer Special caps only be supplied for explosives work throughout the Army.

16. Observation of operations in the Marshalls and discussion with officers in the field have led to the conclusion that the delay detonator has too long a delay in its 15-second time element. The Engineer officer of the 7th Division thought that 7-8 seconds was about right. This was based on use of 5 to 15 second delays for charges employed against Japanese pillboxes in operations on Kwajalein Island. It is recommended that 10 seconds be adopted as the time of the standard delay detonator.

17. Flexible packaging of explosives to allow easy breakdown into various weights of charge is desirable. Engineer officers in the field felt strongly that pack charges should be standard and that front line troops should not have to improvise such charges. Compartmentation of M1 and M2 Tetrytol packs with removable cloth pockets containing four blocks each would allow easy separation in 10-lb. units. This would be a readily available and satisfactory answer to the problem and is recommended.

18. Demolition snakes M2 were on hand in depots in CPA and SPA. However, these items had not been and could not be issued to troops because the target box fuzes (bullet impact type M1) had not been received. Such separation of component parts increases the supply difficulties of theaters and prevents use of such equipment. This situation has been reported to the Office of the Chief of Engineers, which is investigating the matter with a view to remedial action. It is recommended that fuzes be furnished with the snakes in all future shipments.

19. It has been observed that in the erection of barbed wire fences, the present standard barbed wire gauntlets in Engineer Combat Battalions are not essential and are not available in sufficient quantities when needed. The work glove is satisfactory and available in quantity. It is recommended that gauntlets be eliminated from T/E's of all units.

20. Engineer Officers throughout the Pacific Theaters manifested a great deal of interest in small wirecutters. The heavy-duty 9" type, capable of cutting 3/16 inch wire, is not necessary for assault use, since no such heavy wire is encountered. The present long-handled search-nose wirecutters in Engineer units are heavy, unwieldy and unnecessarily powerful. It is recommended that one such wirecutter be retained per platoon, and that the present standard M 1938 Quartermaster wirecutter, now authorized on a basis of 10 per combat company, be supplied on a basis of 2 per squad.

21. Observations of the functions of Engineer units in the field and discussions with various Engineer officers as to the suitability of armament for combat battalions have led to the conclusion that heavy .30 cal. water-cooled machine guns should be replaced by light air-cooled machine guns, on a basis of 1 per squad in Divisional Engineer battalions, Model 1919A6 being a desirable type. It is recommended that this change be made in the T/E's of Engineer Battalions.

22. In the Pacific Theaters, there is little uniformity of employment of camouflage and only limited use of camouflage materiel. This is due to the nature of the jungle growth, which provides ideal concealment for materiel and installations under its cover; to the necessity for making large and unmistakable clearings, that are impossible to conceal, for major installations; and to our complete air supremacy, which minimizes the necessity for and interest in camouflage. Standard camouflage materiel is available and is employed for a variety of purposes, but most of it could be eliminated from organizational supply. Specifically, camouflage nets now furnished for all vehicles, machine guns and emplaced artillery are usually unnecessary. It is recommended that consideration be given to elimination of camouflage materiel from T/E's of

organizations in the Pacific, such material to be furnished as requested by theater commanders.

23. Present 50-foot "metallic" tapes made of metallized cloth stretch badly and rot in the humid conditions of the jungle. It is recommended that they be replaced with metal tapes of rust-resistant type.

24. Because of the fact that land mine warfare has been of very minor importance in the Pacific, it is felt that adoption of Mine Probe M1 as standard organizational Engineer equipment is unnecessary. It is recommended that the mine probe be eliminated from the T/E of Engineer units, and be available in depot stocks at the request of Theater Commanders.

25. It was noted that Australian Engineer stores included a sectionalized 24-inch diameter culvert pipe. This came in half-cylinders about 12 feet long and was nestable. It was reported that it had been extremely valuable in road construction in New Guinea. This material was manufactured by Armco Manufacturing Co., U.S.A. It is recommended that this item be adopted as a standard depot stock item for Engineer supply.

26. Throughout the Pacific, there is insistence on heavy construction equipment. The outstanding item is the invaluable bull-dozer. The D-4's formerly in combat battalions have proved to be too light for continuous heavy construction work. The necessity for rapid completion of road and airfield construction requires that Engineer construction troops have nothing lighter than D-7 bull-dozers; while D-8's are desirable. Engineer Construction Battalions should have one such bulldozer per platoon. It is understood that supplementary tractors for SWPA have been authorized in excess of this allowance. It is recommended that bulldozers be not smaller than D-7 and that they be supplied on a basis of one per Engineer Construction Platoon.

27. For most efficient maintenance and use of tractors and other Engineer equipment, such as shovels, the suggestion is made that manufacturers' representatives on heavy mechanical equipment should be assigned to theaters to furnish expert advice. This could be handled on the same basis as the Air Corps handles technical representatives from airplane plants. In SPA an officer

has been detailed for such work, and makes monthly inspections of units to check on use, efficiency, servicing, and spare parts, of such equipment. If implemented by adequate personnel, expert civilian assistance can greatly increase efficiency of field use of mechanical equipment. It is recommended that manufacturers' technical representatives be sent to all theaters, in numbers to be determined by Theater Commanders.

28. First and second echelon repair and spare parts sets for Engineer machinery and mechanical equipment should be packaged in the United States, rather than being shipped as separate items that require assembly into sets in the theater. Such sets should accompany equipment as it comes into the area, rather than being processed through local supply facilities. It is suggested that manufacturers be asked to prepare a list of spare parts to accompany each item of equipment and to be supplied periodically to maintain that equipment. The Air Corps uses a system of kits of spare parts, which greatly aids in the maintenance of planes. It is recommended that suitable spare parts and maintenance sets for Engineer mechanical equipment be supplied automatically.

29. Engineer officers in SWPA indicated large power plant generators should be low speed diesel type rather than gasoline type. Diesel equipment is preferred in this as in other types of heavy machinery and equipment, as it has a better maintenance factor and is much better adapted to continuous operation. It is recommended that future procurement and supply of large power plant generators be of diesel type units.

30. Because of the large size of the standing timber in SWPA, where many of the trees are 5 feet or more in diameter, small saw mills are not adequate. Inquiries based on requests from SWPA Engineer officers indicate that the Type 7 $\frac{1}{2}$ American Sawmill Machinery Co. sawmill is the type of equipment needed. It is recommended that this item be supplied to fill requirements of that theater.

31. As a result of operations in the field, it has been reported that forestry companies need at least two, and preferably three, two-drum Hyster winches. The first such units received in SWPA had D-4 tractors, which were too

small. Forestry units also need four-wheel trailers, capable of operation over rough country. It is recommended that T/O's of Forestry Companies allow three two-drum Hyster winches per company and that they be supplied with 4 ton, 6 x 6 truck tractor 4 wheel trailer combinations for movement of heavy logs.

32. In the rainy climate of SPA and SWPA, it is necessary that latrines have overhead cover. This is desirable everywhere and many pyramidal tents were in use for this purpose. It is felt that the present standard latrine screen is not suitable, and it is recommended that it be replaced in T/E's by pyramidal tents.

33. It is felt that the provision of binoculars in Engineer and other Tables of Equipment is excessive. Only limited need for binoculars in certain Engineer units is seen. It is recommended that a study be made by Army Ground Forces with a view to the elimination of unnecessary binoculars from organizational T/E's.

C. Signal Corps Materiel.

34. In SPA and SWPA it was reported that the range of the SCR 536 "walkie-talkie" is greatly reduced in jungle operation, possibly due to excessive dielectric absorption in the damp luxuriant vegetation. The opportunity did not present itself to conduct tests to verify these reports, but the subject was discussed with Signal Corps personnel after returning to Washington. It was learned that the difficulty had previously been reported and that extensive tests had been conducted in the jungles of Panama, in the fall of 1943. With SCR 536, ranges of 100-200 yards or less were not uncommon and can be corrected only by major changes in the set, which would greatly increase both its weight and frequency, with resultant confusion in the whole scheme of communications wave-band assignments. On the other hand, the present SCR 300 set has a minimum range of about one mile under the worst jungle conditions in Panama and this can be doubled by the expedient of elevating either the sending or receiving antenna above the trees. Furthermore, the range of both sets can be considerably increased when it is possible to operate in the vicinity of water-courses, which serve as "wave guides".

D. Quartermaster Materiel.

35. For amphibious operations, the need for additional supplies of waterproof covers for small arms weapons was apparent. It is the rule rather than the exception that weapons become soaked in salt water prior to landing, either by spray or due to necessity for disembarking in relatively deep water or surf. Issue of waterproof covers or waterproofing supplies for weapons and ammunition should be predicated on 100% expenditure per landing, with adequate spare equipment for unforeseen needs.

E. Chemical Warfare Materiel.

36. As a result of experiences in the Marshalls and confirmed by discussions with personnel in other theaters, steps should be taken to eliminate the pyrotechnic display incident to lighting of smoke pots. The excessive amount of light given off during this period, when used at night, tends to offset the advantages of screening smoke for protection against air attacks.

F. Medical Corps Materiel.

37. In connection with visits to the Unit Jungle Training Center, CPA, where instruction is given in living under jungle conditions, it was suggested that the oligodynamic sterilization of water be considered. This is an extremely simple method of sterilizing water, requiring only exposure of the water to metallic silver, e.g., keeping a dime in each canteen. Water exposed to prolonged action of silver is not only sterilized but becomes actively germicidal. Inasmuch as knowledge of this effect seems to be very limited, it has been recommended to the Surgeon General, by letter dated 31 July 1944, (See Appendix H), that the subject be investigated with the view of disseminating information and establishing training doctrine for troops in the field.

G. Ordnance Materiel.

G-1. Artillery and Fire Control.

38. In both SPA and SWPA, effective use has been made of the 90 mm AA gun for counterbattery fire, which indicates the possible need for revision of the day of supply to include adequate percentages of PD fuzes for such use, as well as need for a full line of field artillery ammunition for this gun.

39. In anticipation of future operations on larger land masses where much of the operations will be conducted beyond range of covering naval gunfire or in terrain defiladed against flat trajectory fire, CPA and SWPA have requested 8" and 240 mm howitzers. This heavy artillery will be greatly needed in these theaters, although probably not in large quantity, and should be supplied in the near future. It is understood that four battalions of 8" howitzers and two battalions of 240 mm howitzers have been authorized for autumn delivery to CPA. The 155 mm Gun Motor Carriage M12 has also been requested by the theaters and should be made available in the near future. Frequent demands were heard in all the theaters for 155 mm M1 howitzers and guns, and for increased supplies of 155 mm ammunition.

40. In CPA, it was learned that instructions had been received from the War Department to turn in their 37 mm guns upon receipt of the 57 mm guns with which they are being replaced. It was requested that efforts be made to have these instructions modified, as they are very reluctant to part with the 37 mm guns until there is available a full line of ammunition for the 57 mm, including HE and canister. At present, the only 57 mm ammunition available in quantity are the APC and obsolete AP rounds. It has recently been learned that 57 mm HE and canister have been released for procurement and that production of the HE has been initiated. It is believed to be desirable, if not essential, that replacement of 37 mm by 57 mm guns be postponed, at least in the Pacific theaters, until the necessary types of 57 mm ammunition are available in quantity.

41. Fouling and corrosion of the lenses of optical instruments still constitute a serious problem in the humid climate of the tropical jungles. This problem warrants acceleration of the efforts now being made to solve it.

G-2. Small Arms.

42. Improved lubricants and rust preventives are needed for small arms, especially for use in amphibious operations and jungle warfare under tropical conditions. While present lubricants are fairly effective in general, their protective action on surfaces subjected to abrasion and in sliding contact

with other parts is not sufficiently good to prevent rapid rusting. It is understood that Ordnance representatives are now in the Pacific theaters, conducting investigations into these subjects. It is believed that rust preventives must include water insoluble absorbents for metals, which will be stable under severe frictional loads.

43. The carbine is in wide use in the Pacific theaters and, in general, is very well liked. Some difficulties have been experienced due to confusing the safety and magazine catches at times, resulting in dropping the magazine. This may warrant some investigation of the desirability of relocating one of the catches. A clever modification of the carbine magazine, that may warrant further consideration, was made by a medical officer in SWPA. This consisted of welding together three magazines in the form of a "Y", thus making 45 rounds readily available for use. In both CPA and SWPA, proposals were heard to modify the carbine by shortening the stock, attaching a forward hand grip which encloses the magazine, and moving the trigger to the forward grip. A carbine modified in this manner was turned over to the CPA Ordnance Office in March and it was recommended that it be forwarded to the Technical Division for study.

G-3. Tank and Automotive.

44. The medium tank is wanted in all theaters, instead of the light tank, due to its greater ruggedness, its comparative immunity against Japanese mines and other weapons, and its greater fire power. It may be expected that increased demands for medium tanks will be made by these theaters. At least under jungle and amphibious warfare conditions, long range and high velocity tank guns are not required but maximum firepower is essential. The M4E5 medium tank, with 105 mm howitzer, was commented upon as being more desirable than the M4 with 75 mm gun and is wanted as soon as available. No M3 or M5 light tanks are wanted in these theaters, although the M24 light tank may be desired because of its low ground pressure. For tank guns, a full line of canister, HE, APC-HE, smoke and illuminating ammunition is needed immediately.

45. Considerable interest was exhibited in swimming tanks, on which the Ordnance report had been circulated in the theaters. In view of the repeated landing of the same tanks in a single operation, as at Eniwetok, it is essential that the pontoons be readily attachable for repeated use, as is possible with the new BB device. In this connection, attention is directed to the Japanese swimming tank captured by the 7th Division at Kwajalein, which was forwarded to Aberdeen Proving Ground in March. This tank is unique in that it has internally operated clamps, by means of which the pontoons can be readily attached or released, and is provided with rudders and twin propellers.

46. In CPA, attention was called to what appears to be a defect in design of the DUKW, in that the bilge pump operates from the propellor drive shaft and hence runs only when the propellor runs. While the reason for this is to prevent burning out the pump when operating on land, it resulted in loss of at least one DUKW in the Marshalls operations. This DUKW had been damaged by enemy fire and sank while standing-by for hoisting aboard a transport. It would seem desirable to alter the point of take-off of the pump drive to permit operation independent of the propellor. This has been discussed informally with the Ordnance Department and feasibility of such a modification is being investigated. The DUKW has proven to be invaluable in unloading ships in the Pacific areas. Its slow speed makes it undesirable for use in initial landing waves, while the tires are quite vulnerable to the rough coral of the reefs. The O.D. painting of this vehicle should be abandoned and a suitable paint for marine use adopted.

47. The LVT forms the backbone of the assault wave in Pacific landing operations. Its ability to climb over natural obstacles in the water is a decided advantage. More armor, greater fire power, (e.g., 75 pack howitzer), and better mechanical reliability are desired, indicating the need for a completely new amphibious tank. The LVT (4) with ramp is desired, especially for landing artillery in amphibious operations. In maintenance of LVT's in the field, Ordnance service is considerably handicapped by being responsible for this function while having no control over spare parts for these vehicles.

G-4. Ammunition.

48. In the Pacific areas, considerable difficulty has been experienced with erratic ranges and dispersion of white phosphorus filled shells, due to horizontal storage under tropical conditions. Despite efforts to enforce vertical storage of such ammunition, it is impossible to insure that this is done at all times, e.g., during water shipment, when hold temperatures may be excessive. Such being the case, it is recommended that efforts be made to design suitable baffles or other devices for such shells, to insure maintenance of axial symmetry and proper center of gravity even though the phosphorus melts or becomes plastic.

49. Due primarily to terrain conditions in the jungles of Bougainville and New Guinea, there is urgent need for firing tables for high angle fire (above 60°) of howitzers. This subject was discussed by artillery officers of a number of divisions. In the absence of such data, several divisions were conducting experimental firings to develop provisional tables for such use. Since returning to the States, it has been found that high angle howitzer firings have been completed at Aberdeen Proving Ground and that the necessary firing tables will be forwarded to the theaters in the near future. This should be expedited and the tables forwarded in sufficient quantities to permit distribution to all appropriate units.

50. In tests made at Tarawa against Japanese tetrahedrons, difficulty was experienced in detonating Composition C explosive with No. 8 caps. It was reported by various Engineer officers that similar difficulties had been experienced by them in using Composition C. Inasmuch as these failures may be evidence of a decrease in sensitivity of Composition C, especially under tropical conditions, it has been informally recommended to the Ordnance Department that tests be undertaken to determine whether such deterioration does occur. At the same time, it was recommended that similar tests be made with Composition C-2 and with the new plastic explosive PEP-2, as well as with the experimental insensitive PETN plastic. Since all of these plasticized explosives have the general properties of colloids, which are thermodynamically unstable, it is important to determine their rate of change in properties as functions of time and conditions of storage.

51. In view of the characteristic activity of the Japanese in night raiding and infiltration, the need for illuminating projectiles for all mortars and artillery from 75 mm through 155 mm is acute. In CPA especially, wide use has been made of Navy 5" star shells, as well as of the 60 mm mortar illuminating projectile. Until recently, the 60 mm shell was not available in sufficient quantities, but it is understood that this situation has now been corrected. The Navy 5" star shell proved most valuable in the Marshalls operations, despite the high percentage of failures observed. It is understood that the cause of these failures has been determined and that corrective action has been taken. In view of the effectiveness and wide use of the 4.2" chemical mortar for infantry support, it was apparent that an illuminating projectile is required for this mortar. Recommendations for development of such a round were forwarded to the War Department in March and it is understood that action has been taken. Development of illuminating projectiles for the 81 mm mortar, 75 mm gun and howitzer, 105 mm howitzer, and 155 mm gun and howitzer, now being carried on by the Ordnance Department, should be expedited and this ammunition made available in the theaters as soon as possible.

52. Artillery officers in SWPA and SPA expressed the need for incorporation into all HE ammunition of a small amount of white smoke mixture, in order to help in spotting and target designation. This is wanted for 105 mm and 155 mm ammunition especially. It was explained that this would decrease the terminal ballistic efficiency of the ammunition, but proponents of the proposal felt that the increased accuracy of fire, especially under jungle conditions, would offset any reasonable reduction in efficiency. It is believed that the feasibility of incorporation of smoke mixture in HE ammunition should be investigated and it is understood that this is in progress.

53. The development of colored smoke ammunition for all mortars and for artillery from 75 mm through 155 mm should be expedited and this ammunition made available in the theaters as soon as possible. It was also recommended by radio H-7905, dated 11 May, to the War Department that development of long-burning base-ejection colored smoke ammunition for 4.2" chemical mortars be undertaken, in order to increase the flexibility of use of this powerful weapon.

54. The canister ammunition now available for 37 mm guns has proved to be most effective, and similar ammunition is wanted for the 57 mm gun, 75 mm gun and howitzer, 3" gun and 105 mm howitzer. It is recommended that completion of development and supply of this ammunition be expedited. Canister for the 75 mm gun is especially needed because the medium tank is much more widely used and more suitable for combat than the light tank. It is understood that canister for the 75 mm howitzer is in limited production, hence, it should be possible to produce canister for the gun without delay. Since the M4E5 tank with 105 mm howitzer will soon be available for supply to the theaters and is desired, production of 105 mm canister should be initiated in time to be available when the tanks are supplied.

55. To improve the armor piercing performance of the 37 mm gun, especially the 1500 ft/sec "Jungle 37", it is recommended that a shaped charge round be developed for this gun. While the present 37 mm armor piercing ammunition is effective against Japanese light tanks at short range, a more effective round will be necessary against heavier armor. A shaped charge round should meet this need and is particularly needed for the low velocity gun. Necessity for development of a shaped charge round for the 37 mm gun is to some extent contingent upon the proposed replacement of 37 mm with 57 mm guns and would need to be correlated with that action. There should be no serious technical difficulty in producing an effective shaped charge 37 mm round, in view of the known performance of the Japanese and German shaped charge rifle grenades.

56. Consistent with results obtained by the Infantry Board and Ordnance Department, the theaters complain that the MK IIAL fragmentation hand grenade is relatively ineffective. In SWPA, the Australian hand grenade is preferred and is used whenever available. Information was disseminated relative to the recently adopted modifications of the MK IIAL, comprising adoption of a detonating fuze and TNT loading, with resultant marked improvement in effectiveness. It is recommended that shipment of MK IIAL grenades to the theaters be discontinued immediately and that all future shipments be of the improved MK II (TNT) type. When these grenades are first supplied to the theaters, full ballistic

data should be furnished to all Ordnance officers, in order that troops may receive adequate information relative to the increased danger radius of this grenade.

57. In the report of the Marshalls operations, it was recommended that production of the now obsolete MK IIIA1 offensive grenade be resumed, because of continuing requirements for this ammunition. It has recently been learned that stocks of this grenade are adequate to meet current requirements, hence, manufacture has not been resumed. Meanwhile, development of the new magnesium-body offensive grenade (T15), which is much more effective than the MK IIIA1, is nearing completion. It is recommended that this development be completed as soon as possible, in order that this new grenade may be made available in the theaters at the earliest possible date.

58. Especially in SWPA, where the density of the jungle frequently necessitates firing through trees, numerous requests were made for fuzes for mortar and artillery ammunition that will not function on trees or foliage on the ascending portion of the trajectory. This requirement is not novel and is included merely to indicate the continuing need for incorporation of such a characteristic in these fuzes.

59. Existence of the hemispherical Japanese anti-boat mine, for use in connection with underwater obstacles, serves to accentuate the fact that no analogous mine is provided in American ammunition. This was discussed with appropriate Army and Navy officers in the various theaters, in an effort to determine whether a requirement exists for such a mine. None of our present mines, either Army or Navy, are suitable for the purpose indicated, since Navy mines are too large, while Army mines are too small and light and are incapable of suitable actuation. The consensus of the opinions expressed was that, since such mines are essentially defensive, while we are definitely on the offensive, no pressing need for them exists at this time. On the other hand, it was recognized that we have no mine suitable for underwater beach installation and that preparations for defense of captured areas would desirably include such installations. In fact, in a few of the CPA islands, it was understood that extemporized

underwater beach mines were being locally produced. It is recommended that appropriate consideration be given to the military requirements for a mine to serve the purposes of the Japanese hemispherical anti-boat mine, for beach and underwater use in sea water.

60. In CPA, conferences were held on 27-28 June, with General Ruffner, Capt. Hill, USN, Col. Engelhart, Col. Keliher, Capt. Butts, and others relative to release of the T74E6 fuze for AA use. The Navy has been using the MK 32 fuze, under certain restrictions, for some time, and considers it to be of such value as to warrant drastic restriction of use and dissemination of information. The conference agreed that it was proper to interpret the War Department instructions to limit training in and use of the T74E6 fuze to appropriate forward areas. It is believed that it would be desirable to clarify instructions to the Pacific theaters, so as not unduly to restrict combat use of this fuze, while at the same time limiting dissemination of information and use of the fuze to the appropriate areas. This matter has been informally discussed with the Ordnance Department and the views expressed above appear consistent with the intent of the War Department in release of the fuze.

61. In the report of the Borden Mission to CPA, dated 12 January 1944, the unsatisfactory results of tests of locally made T3 shaped charges were reported. The subject was reopened during the visit of this mission and additional locally made T3 charges, produced in accordance with information furnished to the CPA Engineer, were tested in comparison with factory made T3 charges. Results of the tests, together with appropriate recommendations, were made to the Commanding General, USAFICPA, under date of 31 March 1944, copy of which is enclosed herewith as Appendix I, together with photographs Nos. 33, 34 and 35, showing results of the tests made. It was found that the locally made charges, loaded with Composition C-2 explosive, produced reasonably good results provided the cones are annealed in accordance with specifications.

G-5. Rockets.

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62. In the Admiraltys operation, it was reported that approximately 50% duds occurred with Navy 4.5" BR rockets. This had been traced to corrosion of fuze parts of the MK 137 fuze, which was reported to and investigated by Dr. Fowler of CIT during a recent visit to SWPA. It was understood that he will initiate the necessary corrective action through Navy channels.

63. Considerable difficulty is experienced with Navy rocket launchers on landing craft, due to short circuiting by salt water during approach to the beach. Waterproof covers should be provided for these launchers, if possible, or adequate waterproofing of wiring and contacts developed and kits supplied, so as to increase dependability of these very useful and effective adjuncts to the fire power of assault waves.

64. Inquiries made throughout the theaters indicated that, until recently, training in and use of the Bazooka had been so limited, due to its withdrawal for modification last Fall and to shortage of ammunition, that troops were comparatively unfamiliar with the potentialities of the weapon and had little confidence in it. Efforts were made to correct this condition, both by discussions and demonstrations. Reports of effective use of the Bazooka at Biak and at Saipan, against Japanese tanks and bunkers, are understood to have greatly increased confidence in the power of this unique weapon.

G-6. Bombs.

65. In SWPA, it is understood that the former enthusiasm for wire wrapped demolition bombs and nose extensions for bombs has subsided and that these devices are not now being used. It was reported that none of the nose extensions supplied from the States last year have been used.

66. In view of the extremely effective use of torpex filled torpedoes and depth bombs, the CINCPAC Gunnery Officer, Capt. T. B. Hill, recommended that the Army give serious consideration to approval of torpex for filling GP bombs. The increased hazards resulting from use of torpex are

recognized, but it was stated that the markedly superior results obtained are considered to offset those hazards and justify its use. The Navy, at least, wishes to be supplied with torpex loaded GP bombs.

67. Numerous fragmentation bomb duds were seen in areas of recent action, this being especially true at Wakde Island, where the local Air Ordnance officer reported that more than 300 duds had been found. The majority of the duds seen had apparently been dropped from too low an altitude to arm, although some also had been dropped safe. The subject was discussed with General Kenney, who felt that the percentage of duds was low. It was also mentioned that efforts are being made to reduce the arming delay of these bombs, in order to reduce duds and still permit bombing "on the deck", which is necessary to reduce casualties incident to low altitude operations.

68. To provide additional safety for very low altitude use of demolition bombs and to prevent random ricochets, SWPA has developed satisfactory parachute attachments for G P bombs, using the parachute from the 20 lb. "parafrag" bombs. One such parachute is attached to the fins of 100 lb. and 250 lb. bombs and two to 500 lb. bombs. It is reported that the parachutes perform satisfactorily, do not rupture, and prevent ricochets. The Seventh Air Force has obtained samples of these devices from SWPA and plans to construct them for use in CPA.

69. In most of the captured territory, considerable quantities of Japanese bombs of all sizes were found, which, for the most part, remained in their original dumps or were being destroyed. Sporadic use of these bombs was being made by our forces, using extemporized carrying devices. Last year a quantity of fuzes and lug-bands was made by the Ordnance Department for the Navy, but it was reported that none have been used by the Army. Since Japanese bombs are admittedly quite effective and are available in considerable quantities, it seems highly desirable that they be expended against their former owners. Besides saving highly critical ship tonnage, such use will obviate the necessity for demolition or other disposal of this ammunition. It is recommended that the Ordnance Department furnish suitable fuzes and lug-bands

to permit carrying Japanese bombs on American planes and that they be used whenever available and appropriate to the mission.

70. The recently developed butterfly bombs are now available in the theaters, especially in CPA, where training in their use has been undertaken. In view of their limitation to a maximum altitude of 4,000 feet, the Ordnance Officer of Seventh Air Force stated that they could not use them in current operations. It was recommended that these bombs be modified to permit dropping from higher altitudes or that aimable clusters for high altitude use be developed for the present bombs. Of the alternatives, the latter is preferable and the clusters should be suitable for use from at least 10,000 feet and preferably up to 30,000 feet. It is understood that both alternatives are being investigated by the Ordnance Department, under high priority, and that there is excellent possibility of modifying the clusters for high altitude use. Suitable modification parts should be supplied to CPA as soon as possible.

71. The development of a small shaped charge bomb, similar to the Japanese 1/3 and 1 Kg. bombs, which are dropped in clusters, is recommended. These bombs should be quite effective in attacking the characteristically widely distributed Japanese fuel and ammunition dumps. Several years ago, the Ordnance Department developed a 20-lb. shaped charge bomb, based on the metal parts of the 20-lb. fragmentation bomb, for attack of tanks, but this was rejected by the Air Force after tests at Eglin Field. Subsequently, clusters (T5) for use of M9A1 shaped charge rifle grenades were developed for the same purpose, but were similarly rejected. It seems quite possible that the clustered M9A1 rifle grenades would be suitable for the purpose of attacking dumps, besides being quite effective as anti-personnel bombs. Tests of these clusters in the field would seem to be desirable, prior to undertaking development of a new small shaped charge bomb. Adequate safety of the M9A1 grenades can be obtained by a simple modification, comprising substitution of an anemometer-vane arming stem for the present spring safety pin.

G-7. Aircraft Armament.

72. Some investigation of the use of 75 mm guns on B25 planes was

made. In CPA, they were reported to be effective against Japanese defenses when used in low altitude strafing, although the number of rounds that could be fired on a short run was considered to be too small. In SWPA, it was felt that the length of straight approach required for effective use against ground targets was much too long, and excessive casualties from AA fire resulted. Furthermore this plane does not accomodate a co-pilot. It was felt that these planes could be effectively used against barges and small ships, but the number of such targets is too small to warrant their daily use. In SWPA, it was felt that B25's equipped with a maximum number of forward-firing .50 cal. guns, plus parafrag and para-GP bombs, were more effective than when equipped with 75 mm. guns, due to their large fire power and ability to take evasive action while approaching the target. For these reasons, the 75 mm-equipped B25's appear to be little used at present.

73. In the field of aircraft rockets, the Navy has made wide and reportedly effective use of the 5" rocket on fighter planes. Considerable stocks of Army 4.5" rockets and T30 launchers are available in the theaters, but lack of mounting kits for their installation on planes has restricted their use. In CPA, a limited number of kits were available prior to the Saipan operation and rockets were used by the Seventh Air Force in that operation, (mounted on P47 planes). It was stated that they had proved quite effective and that additional mounting kits, rockets and launchers are urgently needed. To meet immediate requirements, it was understood that rockets and launchers had been borrowed from SPA. In SWPA, General Kenney stated that fighters were used for long range, high altitude bomber protection, rather than for low altitude strafing, and that the reduction in speed and range incident to use of rockets made them inapplicable to fighters. He did, however, indicate that they would be potentially useful on A20 and B25 planes, which are used for strafing. A mounting kit for P47 planes was adapted to an A20 for demonstration purposes and the tests made resulted in forwarding requirements for considerable quantities of equipment for A20 and B25 planes, as indicated by the enclosed letter (Appendix K) from Fifth Air Force to USAFFE.

It was General Kenney's opinion that B25's could be more effectively used with rockets than with 75 mm guns, and with less danger to the planes because a long straight approach is not required. It is recommended that steps be taken to supply the necessary kits for A20 and B25 planes to SWPA at the earliest possible date, and that CPA requirements for P47 kits be met, if necessary, by diversion from SWPA.

74. In SPA, the installation of rockets on fighter planes had not been possible owing to lack of mounting kits, consequently the efforts of the Ordnance personnel then (April-May) in the theater to furnish technical assistance were more or less abortive. Using mounting kits for P38 planes, available for the demonstration mission of the group, Major Bolster trained a number of pilots in their use and assisted in conducting a tactical demonstration against a captured Japanese AA gun position at Kolumbangara, on 11 May 1944. A copy of the report of these tests is enclosed as Appendix L. Subsequent to completion of the mission in SWPA, Major Bolster returned to SPA about 10 June, on request of General Harmon, and spent an additional two weeks in further instruction of 13th Air Force fighter pilots. As a result of the demonstrations and tests of rockets made for and by the 13th Air Force, it was considered that their accuracy and effectiveness were sufficient to warrant operational use, and early shipment of mounting kits for P-38 planes was requested. However, the final outcome was somewhat in doubt, due to impending transfer of operational control to SWPA and because of the previously discussed views of General Kenney relative to the types of planes suitable for mounting of rockets. A serious objection to use of 4.5" rockets on fighter planes is the resulting reduction in speed, amounting to 30-35 m.p.h. in the case of the P-38.

75. With further reference to installation of wing-mounted rockets on all types of planes, questions were raised as to possible interference between rocket mounts, wing bomb racks and wing tanks. This group was unable to answer these questions, but recommends that appropriate consideration be given by AFDAO and information be supplied to the theaters. If such

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interference exists, efforts should be made to eliminate it, in order to avoid unnecessary limitation in tactical use of the planes.

76. In connection with aircraft rockets, Capt. T. B. Hill, recommended that action be taken to standardize on aircraft rockets for the Army and Navy, this being particularly important in the Pacific Theaters. As between the Navy 5" rockets with zero-rail launchers and the Army 4.5" rockets with tube launchers, he favored the former because of the reduced drag of the zero-rail launcher and the increased effectiveness of the larger rocket. Since returning to the States, it has been learned that the Air Force has already taken action in this matter and plans to standardize on the 5" Navy rocket.

V

DEMONSTRATION MISSIONA. General Discussion.

1. The second mission of the group comprised giving demonstrations of new weapons and new uses of standard weapons especially suitable for beach assault and related operations. Equipment and ammunition for the demonstrations was assembled at Benicia Arsenal on 25 February 1944 and divided into six equal sets. These were shipped by water between 7 and 13 March to the appropriate bases in the three theaters, under convoy of Ordnance non-commissioned officers. Each set comprised 84 separate items aggregating approximately 25 tons, exclusive of tanks, landing craft, artillery and other standard materiel which was secured locally. After the demonstrations, all remaining ammunition and equipment was turned over to G-3 of the appropriate organization, for further study and use by the troops, except that aircraft rockets and launchers were released to the appropriate Air Forces.

2. Prior to dispatch of the demonstration equipment, letters were sent to the theaters listing the items to be demonstrated and specifying the minimum target requirements. These consisted of six Japanese type coconut log bunkers, a six ft. thick concrete wall, Japanese log wall, Japanese tetrahedrons, and barbed wire entanglements. All of the required targets were made available in CPA and SPA. In SWPA, lack of suitable terrain, unavailability of concrete and stress of current operations limited the targets provided and necessitated improvisations in conducting the demonstrations. At Finschhafen, a suitable beach area was not available, which prevented demonstration of underwater demolitions and firing from landing craft. Throughout the theaters all personnel involved, from theater commanders down, exhibited the keenest interest in the demonstrations and gave all possible assistance and cooperation to insure their success.

3. Demonstrations were conducted as follows:

Central Pacific Area: (See Photos Nos. 36-42 incl.)
Oahu, T. H., 28-29 March 1944.

South Pacific Area: (See Photos. Nos. 43 and 44)
Noumea, New Caledonia, 28-29 April 1944.

Guadalcanal, Solomon Islands, 6-7 May 1944.

(A third demonstration was planned for Bougainville but was cancelled).

Southwest Pacific Area: (See Photos, Nos. 45-48 incl.)

Milne Bay, New Guinea, 18-19 May 1944.

Finschhafen, New Guinea, 24 May 1944.

Distribution was made of catalogs which contained descriptions of the items demonstrated and of some seventy additional items. All items in the catalog were considered in determining requirements. For each demonstration, programs and questionnaires were distributed, the latter being collected at the conclusion of the show. A program for the CPA show and a sample page of the questionnaire are included as Appendix M. Each of the demonstrations, except the last, occupied two days and was divided into:

- a. Static display and description of items,
- b. Demonstration of demolition of beach and underwater obstacles.
- c. Demonstration of firing of mortars, artillery and rockets against resistant targets from landing craft and shore positions and of rockets from fighter planes.
- d. Technical moving pictures appropriate to the demonstrations and pictures of the Marshalls operations.

4. Attendance at the demonstrations was excellent, was limited only by the facilities available and varied from about four hundred at Oahu to more than 10,000 at Milne Bay, where most of the personnel of the Sixth Division witnessed the firing. At all of the demonstrations, commanders and staffs of the Army, Navy, Marines, Air Force, Allied land forces, and of the armies, corps and divisions in the areas were present, as well as selected officers and enlisted men of combat units. The demonstrations were well received and were commented upon as having served a useful purpose. Theater commanders and staff officers stated that demonstrations of new material are desired at appropriate intervals.

5. Requirements for the new weapons and equipment demonstrated were established before leaving each area, after conferences with appropriate staff sections and special staff personnel. In general, these requirements were based on opinions expressed by official observers at the demonstrations,

supplemented by advice from members of the mission. It was stressed that no promises could be made as to delivery dates or quantities that could be supplied. Of approximately one hundred items demonstrated and described, seventy seven were requisitioned in various quantities by the three theaters. Requisitions were prepared and submitted in accordance with letter instructions from the War Department to the theaters, supplemented by instructions prepared by the group, and requisition numbers contain the special consignee designation "ROS". Requisitions were forwarded through normal supply channels, copies were forwarded direct to General Borden and additional copies were retained by the group. On return to the States, SFPOE was visited to coordinate the requisitions with Lt. Colonel Markert. A tabulated summary of the material requisitioned is included as Appendix N.

6. Some difficulties were experienced with equipment and some equipment shipped by air was not received or located in time for the demonstrations. It is believed that, for similar missions in future, sufficient time should be allowed to permit assembling all equipment in advance at Aberdeen Proving Ground and conducting a "dry run", thereby assuring availability and proper operation of all items before dispatch to the theaters.

7. For overseas shipment of materiel for special missions, it is recommended that letters or radios containing advance information and instructions relative to handling of the shipment be forwarded for the appropriate base supply officers. This should be in addition to the present policy of furnishing copies of movement orders, which, because of their classification, are not usually available to officers most directly concerned in handling such shipments. This recommendation is based upon information obtained from Engineer, Ordnance and Signal Corps officers at several bases. In addition and to the extent possible, these advance instructions should specify that the shipment be held in segregated storage, rather than being dispersed in depots of the various supply services. Some materiel so dispersed was not found at all and much time and effort were expended in retrieving other materiel.

8 ~~SECRET~~riel for special missions, it is recommended that advance radio notification be sent to the base supply office concerned, giving addressee, date of shipment, air priority number and, if known, air waybill number, plane number and date of departure. Such information is essential to afford timely notification of shipments and to permit them to be located and held until called for. Several items shipped by air for the demonstrations either were not located at all or only after expenditure of much time and effort.

9. The attachment to the mission of Major Bolster and Sergeant Sohnrey, to handle the installation and demonstration of aircraft rockets, contributed materially to success of this phase of the mission. They were thoroughly proficient in their work and accomplished the mission to the satisfaction of all concerned. Major Bolster's services were also most valuable in his additional mission covering the training of pilots in the firing and tactical use of rockets.

10. As a result of the demonstrations conducted, from observations in the Pacific theaters, and from discussions with responsible G-3 and other officers, it is concluded that early introduction of large caliber rockets for use by ground forces, other than the tank-mounted and T35 "jungle" rockets, will be hampered by lack of personnel and organizations with suitable training and equipment. In view of the ceiling on troop strengths and limitations of knowledge as to the effectiveness and tactical employment of rockets, organization commanders are justifiably reluctant to replace any of the standard weapons, whose capabilities and use are well known. Furthermore, the large dispersion of present rockets limits their immediate application in combat to missions that cannot be accomplished with standard weapons, such as laying down sudden high concentrations of fire. If extensive use of rockets is to be made by the ground forces in this war, it will be necessary to organize, train and equip special rocket companies, and furnish them to the theaters in addition to present authorized troops. In view of the potential value of rockets in ground operations and because of their effective use by both the Russians and Germans, it is recommended that serious consideration be given to organization of such units.

B. Ordn

Items.

11. Launcher, Rocket, A.T., 2.36" M9. This new two piece bazooka was previously demonstrated by General Borden as the T21E2 and is identical except for substitution of the bar sight for the optical ring sight. Recent encounters with Japanese tanks at Biak indicate the importance of this weapon. The new T12 rocket, with bore-safe fuze that will function on mud and water, will greatly increase effectiveness of the bazooka.

12. Launcher, Rocket, 4.5" M12 (T35E1). This rocket was also previously demonstrated by General Borden and was included in our equipment to demonstrate the new tripod mount, which was considered to be more stable and more flexible for use in various types of terrain. There is no question of the power of these rockets to penetrate Japanese type bunkers, but their inaccuracy requires that they be used in multiple to insure that hits will be obtained. (See Photo No. 49). In using the rockets in this way, care must be taken to position and aim them so as to prevent mutual interference in flight and detonation. Launchers should be dispersed laterally and in depth, and should be aimed at different points on the target.

13. Launcher, Rocket 4 $\frac{1}{2}$ " 3-Tube, M10. This aircraft launcher was included in the equipment demonstrated to assist in the evaluation of the 4 $\frac{1}{2}$ " rocket for ground to ground application. Although the Air Forces in the various theaters had received rockets and launchers, no kits for mounting the launchers on the planes were available. Therefore, the equipment brought by the mission served the dual purpose of demonstrating the 4 $\frac{1}{2}$ " rocket as a beach assault weapon and in introducing this weapon to the Air Forces.

14. In CPA, one P47 plane was equipped with rockets and fired at the demonstration on 29 March. It had been planned to fly two missions, but the second was cancelled due to rupture of two tubes during the first mission. These ruptures were not due to rocket motor separations, but appeared to be associated with use of spliced tubes. The occurrence was reported by radio from CPA dated 31 March 1944, an extract from which is enclosed as Appendix O. A full report on the subject was to have been prepared by Lt. Gnam and forwarded through the Ordnance Officer, Seventh Air Force, to AFTAO.

15. In SPA, a rocket-equipped P38 plane was not made available in time for the Noumea demonstration. However, two such planes were fired quite effectively at the Guadalcanal show. General Harmon and others of the 13th Air Force and ground force officers expressed satisfaction with the results and appeared impressed with the accuracy and effectiveness of the rockets. The third P38 kit available in SPA was installed subsequent to the demonstrations for training of additional personnel.

16. In SWPA, where two P47 rocket kits were available, lack of time prevented completion of the installations in time for the show at Milne Bay. In accordance with previous agreement with General Kenney, and with Major Bolster's concurrence, one of the kits was adapted to an A20 plane. While the mount finally devised could not be jettisoned, it did permit firings to demonstrate applicability of rockets to those planes and resulted in requirements for kits for both A20 and B25 planes. Unfortunately, neither of the planes was used in the Finschhaven demonstration, so that no general showing of aircraft rockets was made in SWPA. The P47 plane was damaged in take off, due to blowing a tire, while the A20 was diverted to a demonstration for the bomber command.

17. Launcher, Rocket, 4.5", Multiple, T27. This 8-tube launcher for the Army 4.5" rocket was fired from the stern of LVT's and DUKW's and as a ground mount. When fired from the LVT or DUKW, the inaccuracy of the rocket coupled with the unstable platform gave great dispersion at comparatively short ranges (700 to 1000 yards, approximately 50 to 80 mils elevation). It was generally the opinion that the Navy 4.5" Rocket fired from the automatic Mk VII launcher had greater utility because of less weight, greater simplicity, and high angle of fire with consequent reduced dispersion at short ranges, especially from unstable platforms. There is definite need for a positive locking device for the elevating rack on the T-27. On two occasions when the launcher was fired ripple, the elevation dropped to below zero. The arrangement of the equilibrator greatly reduced the stability of the mount. Also it was indicated that the generator could be turned too fast to function the

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firing mechanism. The electrical contact arms are not satisfactory and a more adequate type should be developed.

18. Launcher, Rocket, Multiple, 4.5" T34. This 60-tube launcher for the Army 4.5 rocket was mounted on the various types of M4 Medium Tanks and fired from ponton barges, LCT's and on the ground. The fire power of this launcher was impressive, but excessive dispersion occurred when the launcher was fired full ripple. This dispersion was partly due to instability of the front trunnion attached to the gun and partly to the arrangement of the equilibrators. On one occasion when the launcher was fired without the equilibrator, much greater accuracy was obtained. By changing the front trunnion so that it is attached to the gun mantle, the moment placed on the gun barrel would be greatly reduced, and also it would permit the 75 mm gun to be fired while the launcher is attached. The use of fragile plastic tubes in jungle terrain is open to serious question. Considerable difficulty was encountered with the electrical firing mechanisms. Of the five installations made, not one firing mechanism would function properly after initial installation. Such faults as improper adjustment of relays, broken lead wires, and power connections reversed were encountered. Part of this could have been caused during shipment, but poor inspection was indicated. A simple manually operated firing mechanism, without relays, would be much more desirable. Other difficulties encountered with this launcher were that the side trunnions were grossly oversize, causing interference with the bank of tubes. On one occasion, only 49 rockets could be inserted due to undersize or pinched tubes. During only one demonstration could the full complement of 60 rockets be inserted. Contact arms and electrical connections on the launcher should be strengthened to withstand backblast and all exposed wiring should be assembled in armored cables securely attached to the tubes. Fin lock latches require redesign to prevent unseating of rounds by backblast.

19. Launcher, Rocket, Multiple, 7.2" T40. This 20-rail armored launcher was mounted on the various types of M4 medium tanks and fired at close range at concrete walls and Japanese type bunkers. This launcher was

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liked very much and should prove to be a valuable weapon against Japanese defenses. As in the T34 launcher, considerable difficulty was encountered with malfunctions of the firing mechanism and a simple manually operated type should be developed. The launcher should also be modified as suggested for the T34, to permit firing the 75 mm Gun. While this launcher was designed primarily for demolishing concrete obstacles in the European theater, it was found to be most effective as a "bunker buster". At each demonstration in SWPA, two Japanese type coconut log bunkers were destroyed with six to eight rounds per bunker. (See Photos Nos. 50 and 51). The power of the 7.2" rocket launcher was most impressive. Despite its limited range, it was much preferred to the T34 launcher and was requisitioned under high priority by all theaters. During the demonstrations, only 13 to 15 rounds of the 20 provided were useful. About four misfires and two or three duds were normal. In the Guadalcanal demonstration the firing mechanism shorted out on the first round fired and could not be repaired. At the CPA show 14 rounds failed to breach a heavily reinforced 6 ft. concrete wall, as shown in Photo No. 52.

20. A question frequently asked was as to the effect of small arms and artillery fire on rockets, particularly as regards the T34 and T40 installations. It had to be admitted that such fire might cause detonation of the rockets, with resultant loss of the tank. It is recommended that suitable tests be made to establish the facts and that steps be taken to remedy any defects found. It appears desirable that armor be added to the T34 launcher, both for protection against bullet impact and against mechanical damage in jungle operation; also that consideration be given to loading rockets with the new bullet-insensitive Pentolite plastic.

21. Launcher, Rocket, 8" T . The 8" launcher demonstrated in the Pacific was a makeshift single rail type used only to determine possible requirements for large rockets. The launcher was used as a ground mount and was also fired from barges, LCT's and LCM's. The fuze (T20) for this rocket was not available except for the two demonstrations given in SWPA. It was

the general opinion that if a suitable launcher with prime movers, accessory equipment and trained personnel could be furnished, it would offer a splendid opportunity to exploit the combat utility of large rockets, whose power is most impressive.

22. Launcher, B.R., 4 $\frac{1}{2}$ " Mk IV (NAVY). This single rail launcher was demonstrated as a ground mount, utilizing rapid fire to indicate how a barrage might be laid down with such a weapon. It was generally agreed that a requirement does not exist for such a launcher and that multiple types are preferable. The Magnavox firing mechanism was well liked and should be used for the "jungle rocket" (M12).

23. Launcher, B.R., 4 $\frac{1}{2}$ " Mk II Mod 1 (NAVY). This three rail launcher was demonstrated as a ground mount. Like the single rail launcher, it was the general opinion that a requirement for this type does not exist.

24. Launcher, B.R., 4 $\frac{1}{2}$ " Mk VIII (NAVY). This launcher is a 3 x 4 rail type and was fired from landing craft, barges, and as a ground mount. It is being used successfully and extensively in landing operations in the Pacific Theaters by the Navy and ESB's. The purpose of demonstrating this launcher was to determine Army requirements. Since means are not readily available to alter the elevation, little interest was indicated by ground troops. Its weight and bulkiness were also deterring factors.

25. Launcher, B.R., 4 $\frac{1}{2}$ " Mk VII (NAVY). This automatic 12-round launcher was mounted on barges, LCT's, Jeeps, and as a ground mount, being much liked in all three theaters. Its compactness, light weight and adjustable elevation offer considerable advantages over the 3 x 4 Mk VIII launcher.

26. Rocket, H.E.A.T., 2.36" M6A3. This rocket was demonstrated in comparison with the present issue M6A1. Although it does have advantages over the M6A1, all theaters were anxious to receive the T12 as soon as fully developed.

27. Rocket, H.E.A.T., 2.36" T12. This new rocket, with increased accuracy and bore-safe fuze, was well received in all demonstrations. Its increased fuze sensitivity and high fragmentation efficiency (comparable with

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that of the 60 mm shell) greatly increase the utility of the bazooka. Indications are that more Japanese armored units will be encountered as the war progresses, which should increase demands for this weapon.

28. Rocket, W.P., Smoke, 2.36" T26. This rocket was previously demonstrated by General Borden in the Pacific theaters. There is a definite need for such a round and it should be supplied in quantity at the earliest practicable date. Some of the T26 ammunition supplied by the Borden mission has been used in SWPA, resulting in numerous duds. This was discussed with the Rocket Branch and it was learned that the difficulty was due to defects in the first lots manufactured in 1943, but that these have now been eliminated.

29. Rocket, H.C., Smoke, 2.36" T27. Due to the small volume of smoke produced by this round and lack of incendiary effect, there was no apparent interest in this rocket in the Pacific theaters.

30. Rocket, H.E., 4.5" M8. General consensus of opinion was that this rocket was much more valuable as an air to ground weapon than as a ground to ground weapon. Since the caliber of the 4.5" Rocket is very close to 105 millimeters, it is believed that the 105 mm Howitzer can be employed to advantage in all cases other than as an aircraft installation or as the single tube jungle rocket. Indications are that the 0.1 sec. delay is too long for the ground type rocket and should be reduced to about 0.05 second.

31. Rocket, Practice, 4.5" M9. Indications are that there are only meager requirements for this rocket. In most cases where ranges can be obtained to fire these rockets, it would be satisfactory to fire high explosive rounds. However, they were requisitioned by all theaters.

32. Rocket, Barrage, 4 $\frac{1}{2}$ " (Navy). This rocket performed excellently in all tests but its effectiveness was limited by the instantaneous fuze with which it is now equipped. The packing of fuzes is inadequate and immediate steps should be taken to issue these fuzes in waterproof containers. Consideration should be given to supplying this rocket as a complete round. If it is not feasible to issue the rocket as a fuze round, the fuze should be placed in an airtight metal container in the same package as the rocket.

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The present system of packaging the rocket head, rocket motors and rocket fuzes is unsatisfactory for Army use and very rarely are equal numbers of each component received.

33. With reference to use of the Army 4.5" M8 rocket vs the Navy 4.5" BR rocket, especially for support of amphibious assaults, results of the demonstrations and of the operations in the Marshall Islands indicate that the long range of the M8 rocket (4500 yards) is not needed, while in jungle operations such range would be of limited value. A former deficiency of the Navy rocket, in that it had only an instantaneous fuze, has been eliminated by standardization of a delay nose fuze. It appears, therefore, that the Navy 4.5" rocket, with its lighter launchers and greater fire power meets all current and foreseeable needs for use on landing craft and in support of landing operations. Suitable sighting and fire control equipment is, however, badly needed for most effective utilization of rockets from landing craft.

34. Rocket, H.E., 7.2" T37. This is a very effective rocket and was well liked in all areas where it was demonstrated. Greater range and accuracy would improve its value. Considerable criticism was received as to the vulnerability of this rocket and if possible a plastic explosive insensitive to small arms fire should be used. During the five demonstrations between 5 and 10% duds were obtained, but this was not unexpected because of known defects in the particular lot of fuzes used in these rockets.

35. Rocket, H.E., 8" T25. This rocket has tremendous fire power and a suitable launcher should be immediately developed. The range of approximately 700 yards is satisfactory, but up to 2000 yards would be desirable. Rockets utilizing G.P. bombs up to 4000 pounds, with ranges up to 5000 yards, would be very effective and powerful weapons.

36. Adapter, Grenade, Projection, T2. This item was demonstrated with the colored smoke grenades M16 and M18, the incendiary grenade M14 and the H.C. Smoke Grenade M3, and was very well received. It was found that this combination could be used as a trailing smoke grenade by omitting the lever clamp and permitting the emission of smoke to start before launching

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from the rifle, and this use was demonstrated in SWPA.

37. Grenade, Smoke, Colored, Trailing, T12. This trailing smoke grenade was developed as a front line marker in jungle terrain and was well received. Red, yellow, and violet are the only colors desired, green giving too little contrast to be acceptable. This smoke grenade did not function when the Cartridge, Auxiliary, M7 was used in one demonstration.

38. Adapter, Grenade, Projection M1, fired with 60 mm Shell M49A2. This was demonstrated as an emergency combination and performance was excellent. Technical bulletins on this item had been received in the theaters.

39. Flare, Trip, M48. Varied opinions were expressed about this flare. It was thought that the flare was projected too high and would not light up the ground below jungle foliage. Also it was suggested that it would be better to use the anti-personnel mine to kill an intruder rather than to use a flare to expose him only. Projection of the flare above the trees would make it suitable as a ground-air position signal, provided care is taken to project it vertically.

40. It is pertinent to mention use of the Engineer Delay Firing Device M1 with the M48 Trip Flare. It developed in conferences in SPA that front line troops desired a means of designating targets, for aerial or artillery bombardment, by patrols, while allowing sufficient time for withdrawal of personnel. The delay firing device M1 was demonstrated successfully to activate the M48 trip flare, selecting the desired time interval from the variety furnished in the standard issue boxes. Personnel of 5th and 13th Air Forces exhibited considerable interest in this use of the flare, as did some divisional personnel.

41. Flare, Trip, M49. This flare was considered to be promising for perimeter defense in the jungle. Like the M48 flare, it was suggested that the anti-personnel mine would be more useful. However, a combination of all three should prove very useful. Indications were that better waterproofing of the M49 flare may be required. Several misfires, attributed to exposure to jungle climatic conditions were experienced during the SWPA demonstrations.

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42. Mortar, 81 mm T27. This light weight mortar was very enthusiastically received and was requisitioned in all of the theaters for operational tests. Consideration should be given to substituting this mortar for the standard 60 mm, with appropriate attention being given to the "hand-held" 60 mm mortar T18E6. Substitution of the T27 for the 60 mm mortar would simplify ammunition supply, eliminate present 60 mm difficulties and increase fire power. Opinion was divided as to use of the T27 mortar, varying from complete replacement of all 60 and 81 mm mortars to pooling them for task force use. The range of the mortar appears to be sufficient for present operations and the reduction in weight over the standard 81 mm mortar makes it most desirable for use in the jungle.

43. Shell, Illuminating, 60 mm, M83. This illuminating shell was being received in small quantities in the theaters, but many had not seen it fired. It was very well liked and is a valuable round for use against the Japs. It was not requisitioned, as it is standard and on automatic supply.

44. Bayonet M1 and Scabbard M7. This item was displayed in all areas and was well liked. Some divisions had already received this new bayonet in lieu of the old standard long bayonet.

45. Bayonets, Carbine, T4, T6 and T8. There was little or no interest indicated in the T4 or T6 bayonets. The T8 bayonet was requisitioned for all carbines in CPA and SPA, while in SWPA it was not considered necessary to have a carbine bayonet at all. Since the trench knife is standard, a type that can be adapted to the carbine appears desirable. Although CPA and SPA requisitioned the T8 bayonet, they indicated that they were in no great hurry to receive them. The Marines liked the T8 bayonet and want it in addition to the M3 Knife.

46. Connector, Extended, End, for M4 Tanks (Duckbills). Great interest was shown in this item. Since most of the terrain where the forces in SPA and SWPA are operating is very soft and with practically no rocks, these track extensions should prove very beneficial. These track extensions were requisitioned for the 105 mm Howitzer Motor Carriage M7 and Medium

Tractor M4 in addition to those for the medium tank. A similar track extension is also desired for the M5 Tractor and for the light tank.

47. Fuze, Nose, CP, Tl05. This was one of the best received items and very good results were obtained during demonstrations of this fuze. In Oahu, three rounds fired from the 155 mm gun M1, at approximately 750 yards range, almost penetrated an 8 foot thick heavily reinforced concrete wall estimated at 4000 pounds strength. (See Photo No. 53). At Guadalcanal, a 6 foot concrete wall of estimated 2000 pounds strength was penetrated four times by a 75 mm tank gun fired from a LCM at approximately 400 yards range. (See Photo No. 54). In SWPA, no concrete targets were available, but the fuze was fired in 105 mm howitzer ammunition against log bunkers and excellent penetration was obtained. It should be noted that some complication will result in the supply of boosters, because of the various shells with which this fuze might be used. It is very desirable that a spanner wrench be furnished with these fuzes. Results of tests at Guadalcanal and in SWPA indicated that the 0.05 second delay of this fuze may be excessive, and it was recommended on 11 May that Aberdeen make tests to determine the desirability of reducing it to about 0.02 to 0.03 second. This work is in progress.

48. Torpedo, Bangalore, Mortar Projected, 81 mm Tl. There was no apparent requirement for such a projectile as the mortar projected bangalore, which is erratic and not dependable. Development of this item should be cancelled.

49. Grapnel, Mortar Projected, 81 mm Tl. It was indicated that there was no requirement for this grapnel for use in removing barbed wire obstacles, but it was considered as possibly suitable for use by Engineers to assist in crossing streams or scaling cliffs. However, since the Engineers are not equipped with mortars, this introduces a problem, but one that could be avoided by use of a rocket propelled grapnel similar to the one developed by the Navy at Fort Pierce. The Australian Engineers have developed a grapnel for use in the 3" mortar, which is light and utilizes a rope instead of a cable. (See Appendix G for description).

C. Engineer Materiel and Related Items.

50. The demolition of beach and underwater obstacles was demonstrated to show the application of standard and experimental items of explosives and accessories, which are or could be adapted to the removal of enemy obstacles and mines, both under water and on the beach. This demonstration was designed to illustrate methods of passage of obstacles applicable to landing operations and was based on results of experimentation at Fort Pierce and observation of methods used both in the Pacific and European theaters. The demonstration included: methods of waterproofing explosive circuits in surf; placement of individual charges by demolition details in surf and on the beach; connecting primacord circuits for simultaneous detonation of charges on steel rails and concrete obstacles, both on shore and in the surf; use of the concussion detonator and the 15 second delay detonator for assault and amphibious demolition work; and destruction of Japanese concrete tetrahedrons by detonation of aquatic snakes.

51. Use of framed chicken wire and rubber boats to negotiate barbed wire fences was demonstrated, while the effects of aerial bombardment in breaching barbed wire were shown in Film Bulletin 108, "Beach and Underwater Obstacles". Use of the bangalore torpedo with a 15 second delay detonator in gapping barbed wire was shown. The rapid erection of concertina barbed wire was demonstrated, to illustrate the superiority of concertina over standard barbed wire for hasty defenses.

52. Twenty pound packs of tetrytol (Block Demolition M1 and M2) were detonated simultaneously against Japanese concrete tetrahedrons, to demonstrate that use of one pound of explosive per cubic foot of concrete in small obstacles was a simple 'rule of thumb' for computation of explosives required.

53. Tank-gaps were blown in reinforced concrete walls using hand-placed charges composed of 20 lb. packs of tetrytol. Charges ranged from 600 to 1500 lbs. of explosive. Adequate gaps were blown in all cases, establishing under field conditions the validity of the 'rule of thumb' used for

calculation of quantities of explosives required for massive obstacles; i.e. the height times the thickness of the wall in feet is equal to the number of 20 lb. packs of explosive required; e.g., for a wall 6 ft. thick by 8 ft. high, 48 packs are required. See Photo No. 44 for effects of a wall charge at Guadalcanal. All charges were placed in standard manner prescribed by official training literature. At Noumea, a successful gap was blown through a wall 6 feet thick by 8 feet high, backfilled with sand, by increasing calculated quantities by 50%. The charge was 72 packs, giving 1512 lbs. of explosive. (See Photos Nos. 56, 57 and 58).

54. Bulldozer, Tank Mounting for M4 Medium Tanks. This item was well liked in all theaters. It was demonstrated in the removal of Japanese tetrahedron obstacles and in destruction of Japanese pillboxes. Although the tank drivers had only limited experience in blade manipulation, results were excellent, as shown in Photos Nos. 41 and 59. This item was demonstrated in CPA and SPA, but not in SWPA where no blade equipment was available.

55. Lighter, Fuze, Weatherproof, M2. This new device, which should not be confused with its predecessor, a field expedient for waterproofing fuze lighters, was extremely well received and gave 100% performance in underwater use. It is wanted everywhere for amphibious, wet weather and front line assault demolition work.

56. Blocks, Demolition, M1, M2 and M3. These 20 lb. explosive packs were demonstrated in hand-placed assault demolitions of concrete Tetrahedron obstacles both in and out of the water, concrete walls, coconut log walls, etc. They were highly praised. Tetrytol was preferred to Composition C for general use, while opinion on the M1 and M2 (Tetrytol) packs was about equally divided. M3 packs (Composition C-2) were considered suitable for special purpose use, where the plasticity of the explosive allows increased efficiency of charge placement. Relative to the 1 lb. TNT block, it was recognized that such packaging was superior to the $\frac{1}{2}$ lb. size, but the 20 lb. packs of explosive are wanted for assault use.

57. Detonator, 15-Second Delay, M1. This compact waterproof device,

combining the functions of fuse-lighter, fuse, blasting cap and priming adapter, was universally liked and is wanted in all theaters. Of the large number of delay detonators fired, only one misfire occurred, due to failure of the delay element to detonate the cap. The only modification indicated to be desirable is reduction of the delay time to 10 seconds, as discussed in Part IV of this report.

58. Concussion Detonator. This detonator was demonstrated both in air and in water and was considered to be of potential value. Naval demolition units particularly were anxious to acquire this item. The quantities requisitioned (1000-2000) reflect a desire on the part of the theaters to field test the device, whose characteristics are given in TB 5-25-4.

59. Demolition Equipment, Set No. 5. was very well received. Many improvisations of similar sets, using gas mask carriers, were noted in the Marshall Islands. There is a need for this equipment, which is not yet arriving in adequate quantity through normal supply channels. Set No. 7 (Electrical) was received passively. It should include some M1A1 priming adapters, which are designed for use with both non-electric and electric blasting caps, and this addition to the set was recommended by Radio H-7905, dated 11 May, from SPA. A suggested number is 6 per set. The M1A1 Priming Adapter is considered to be an excellent small item, particularly in view of the fact that all packaged explosives are being provided with threaded recesses. The idea was suggested that priming adapters might well be furnished with threaded explosive. It is realized that such packaging of two separate items may offer complications, but it is worth some consideration. The new Crimper, Cap, with fuse Cutter, M2 performed excellently and was universally desired to replace present cap crimpers in normal course of resupply.

60. New Firing Devices were demonstrated in booby-traps and were well-liked. The Pull-Release Type M3 was requisitioned in small numbers for occasional use in booby-trapping defensive perimeters at night. The Pull Type, Friction, T2 was considered more desirable than the present pull-type device, with the one possible disadvantage that the device may deteriorate in the

tropical climate of the jungle. However, no difficulty was experienced with those used in the demonstrations.

61. Charges, Demolition, Shaped M2A1 and T3. These demolition shaped charges, containing 10 lbs. and 26 lbs., respectively, of explosive, were tested against reinforced concrete six feet thick and against heavy coconut log bunkers. The charges performed excellently in every case, easily penetrating the six foot walls, which were not made of as high quality concrete as that used in development tests at Aberdeen. Against heavy bunkers, the T3 charge penetrated the roofs quite easily and sprayed the interiors of the bunkers with high velocity metal fragments. The M2A1 charges were unable to penetrate very thick bunkers, about three feet being their limit of effectiveness. Since shaped charges had been used in the Marshalls, where they blew gaping holes in weak concrete structures, observers were warned that this is not characteristic of these charges, which are designed to bore small holes in heavy structures. The applicability of shaped charges for use in the Pacific has not been finally determined, but moderate quantities of the T3 charge were requisitioned for training and limited operational use. The use of shaped charges for boring shot holes in quarrying operations was brought to the attention of SWPA, where it was reported that 75 mm AP projectiles had been used for such purposes.

62. A considerable number of items of Engineer materiel included in the catalog but not demonstrated, were discussed with appropriate personnel. The Clearing Saw, Tractor Mounted was considered to have little utility in SWPA because it can handle nothing over 36", whereas the base diameters of many trees are 8 to 10 feet. Similarly, the Sawmill, Light, Portable, Gasoline Engine Driven is too small for SWPA because it can handle nothing larger than 24" logs. Cab, Motor Grader, Armored was generally considered unnecessary since these graders are principally employed in rear areas, although it was requisitioned by CPA. Tractor, Crawler, 70-90 DBHP, with tilting blade, was considered to offer no advantages over other equipment as regards work-production, but could be handled more effectively by unskilled operators.

Beach Attachment

requisitioned for CPA and SPA and had previously been ordered by SWPA. CPA ordered the sets on the basis of 3 per shore party battalion. SWPA was not interested in the A-frame attachment, as discussed in Part IV of this report. The most desirable feature of this set is the inside mounted dozer, which permits transportation in LCM's. Set, Pipeline Equipment, for 2½ ton truck and Trailer, 4-wheel, 7-14ton w/Truck, 4 Ton 6 x 6 are project items but were requisitioned by CPA and SWPA, being considered to be extremely valuable items for handling material and equipment.

63. Propelling Unit, Barge, Outboard Type, 40 HP. This item was wanted for immediate operational use at forward areas in New Guinea. Requisition for one hundred of these units was made by the Transportation Corps, to meet their needs and those of the Engineer Corps. Information was received indicating that the Australians also evidenced considerable interest in this item.

64. Diving Outfit, Set No. 3. In the Pacific theaters, interest in this type of equipment centers in use for offshore work, where the inconvenience of the airhose and necessity for air supply from the surface limit its utility. However, CPA ordered a small number for trial. General opinion in the theaters favored the Navy diving outfit, with integral oxygen supply.

65. Barrage Balloon, Very Low Altitude Type M1. This item was discussed in the Pacific theaters, where it was found that no requirement exists. Allied air supremacy makes such equipment entirely unnecessary.

66. Carpet Roll Torpedo. The primacord net made for this item was exhibited, since similar nets had been improvised for possible use at Kwajalein. However, this item aroused no interest and was not requisitioned, because of its questionable effectiveness in detonating mines, the difficulty of use in mined wire, its vulnerability to small arms fire, and the limited field of use for such items in the Pacific.

67. Snake, Demolition, M2. This item was demonstrated, but not fired, and its use was shown in moving pictures. It excited no interest because field conditions in Pacific theaters do not favor its use; more familiar standard weapons (tanks, artillery, etc.) have been found adequate against Japanese bunkers and other defensive works; and mine fields have not been en-

countered. This item is available in the theaters but components are scattered, and it will probably not be employed unless field conditions change and personnel trained in its use demand it.

68. Paint, Face, Camouflage. This item was considered unnecessary in CPA and SWPA. In SPA, the opinion was expressed that it would be of value for white officers with colored units, and a basis of issue of 100 sticks per infantry regiment was proposed. For general use, it was not considered to be necessary.

69. Wire Cutter, Heavy Duty, 9". This tool is capable of cutting 3/16 inch square wire of high tensile-strength steel and was received favorably because of its small size. As discussed in Part IV of this report, this item is unnecessary and the M1938 Quartermaster wire cutter fulfills all ordinary needs.

70. Kit, Sign, Reproduction was very well liked in all theaters, as requisitions show. It was, in general, desired on the basis of one kit per Engineer Battalion and one per Engineer Special Brigade. It meets a long-felt need for rapid production of legible signs in quantity.

71. Water Purification Unit, Pack. Extensive interest was manifested in the diatomaceous silica water purification unit, particularly because of its ability to remove amoebic organisms not destroyed by chlorine and because it is a pack type unit. It is worth commenting that the Australians have a similar pack unit, but prefer our standard portable water purification set. Lightening of the larger capacity water units by use of the diatomaceous silica method is believed to be extremely worthy of investigation, and it is believed that this has been initiated.

72. Boat, Landing, Pneumatic, Rubber, 10-man was considered to be a good rubber boat, essentially equivalent to the Navy 10-man rubber boat, which was on hand in SWPA and CPA. Because of unfortunate combat experience with rubber boats at Arawe, SWPA was not too much in favor of them. The expressed thought of Engineer Special Brigades was that the Navy 7-man rubber boat was preferable, because it is lighter and can more readily be hand-transported. Some opinion was expressed that these 10-man rubber boats would be

desirable in Engineer Combat Battalions on a basis of two per Headquarters Company. As a result of these conferences and personal experience, it is recommended that the 7-man rubber boat be furnished Engineer Special Brigades, and that consideration be given to issuing it to Headquarters Companies of Engineer Battalions.

73. Lamp, Electric, Portable, Command Post. In SPA the command post light was well received and considered to be extremely valuable for field use. This is in contradistinction to its reception in SWPA, where there was not very much interest in this item, the Coleman lantern being preferred. Generally, the command post lamp appears to be unnecessary, as it is a luxury item. By radio 11 May to the War Department, the recommendation was made to lighten the item by eliminating the batteries, which are standard automobile and truck type.

74. Anti-Tank Mines and Detectors. Of the newly developed mines, the Heavy T6E1, the Light T7, and the Non-Metallic M5, interest was most lively in the light mine, which could be used profitably for perimeter defense at night. Since the Japs have used few mines and no non-metallic types, there was little interest in the Non-Metallic Mine Detector AN-PRS-1 although it was requisitioned in CPA. Both this detector and the standard SCR-625 detector were shown and operated.

75. Mine Probe, M1 is not needed in the Pacific. The present model probe proved to be weak at the bayonet joint, where three out of four probes used broke after very little use. This has been reported to the Office Chief of Engineers and corrective action is being taken.

76. Marker, Luminous, Radioactive, Types I and II. These luminous markers created a great deal of interest and demand, which emphasizes the need of more completely informing troops concerning available standard equipment. Some divisions went too far and wanted one button per man and vehicle. The type II marker was considered especially desirable for use in maintaining contact between landing craft at night. These were preferred to the stake, delineator, reflector, for road marking, since they are self-luminous.

77. Metallizing Equipment, Set No. 1 was an item particularly wanted in all theaters. The basis of demand was one per Engineer Heavy Shop Co., although Ordnance Maintenance Units also found the item desirable. Shop Companies in Engineer Special Brigades especially need such equipment for rehabilitation of propellor assemblies of landing craft.

78. Charge, Demolition, Mk 13 (Navy). This demolition charge, also known as the Reddy Fox or Aquatic Snake, was demonstrated in CPA and SPA for destruction of Japanese tetrahedrons in the water. Its power impressed all observers, but none were requisitioned as they are available through Navy channels if required for special operations. No effort was made to demonstrate tactical placement of the Reddy Fox, and it was explained that this problem has not yet been solved satisfactorily. Moving pictures of Reddy Fox tests at Fort Pierce were exhibited.

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6 July 1944

MEMORANDUM FOR THE CHIEF OF STAFF

Subject: Report of Mission to Pacific Theaters, 31 January
to 30 June 1944.

Principal Observations and Conclusions:

1. The primary operational mission of the group was discharged by preparation of the report entitled "Marshall Islands - Japanese Defenses and Battle Damage," and by its transmission to SPA and SWPA in accordance with instructions. As recommended by OPD, CPA and SWPA are initiating steps to set up "damage analysis" teams.

2. In general, Japanese defenses in SPA and SWPA have been much less extensive and more rudimentary than those in the Gilbert and Marshall Islands. Beach and underwater obstacles either have not been encountered or have been avoided by landing on undefended beaches. Use of land mines and booby traps is very restricted and special equipment and techniques for their removal have not been required.

3. Centralization in Hawaii of experimental work on methods of passing beach and underwater obstacles is desirable, because it is now chiefly a Pacific problem and units staged through Hawaii can be trained there in most recent operationally-tested techniques.

4. The performance of standard ammunition and materiel under difficult climatic conditions has been generally satisfactory and confidence of troops in their materiel is excellent.

5. Firepower of rockets, mortars, tanks and artillery from landing craft can be made adequate to support landing operations during the last 1,000 yards of approach to the beach, and progress is being made in such developments.

6. In SWPA the need was expressed for more medium tanks and tank dozers, 155 mm. ML howitzers, and more adequate supplies of 155 mm. ammunition. Heavier artillery, i.e., 8" and 240 mm. howitzers, are wanted for future operations on larger land masses, where Naval gunfire coverage cannot be obtained.

7. Erratic ranges and dispersion of 105 mm. ammunition continue to be a serious problem. Ordnance technical experts should be sent to Pacific theaters to grade and classify this ammunition.

8. All technical services should organize sections for collection and study of enemy materiel, analogous to the Ordnance Intelligence units now in the theaters. Such sections should have suitable T/O and E's, to eliminate difficulties now experienced by Ordnance units, together with adequate facilities to assure prompt shipment of captured materiel to the United States.

9. The second mission of the group was discharged by conducting demonstrations in Hawaii (28-29 March), Noumea (28-29 April), Guadalcanal (6-7 May), Milne Bay (18-19 May) and Finschhafen (24 May). These demonstrations were attended by the top-ranking commanders, their staffs, line officers and selected enlisted personnel of the organizations in each area, as well as by representatives of the Navy, Marine Corps, Army Air Forces and Allied Land Forces. Enthusiastic cooperation was afforded in every theater, the

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demonstrations were well received, were subsequently commented upon as being instructive and helpful, and continuation of the policy of sending out demonstration teams is desired.

10. Of approximately 100 items of equipment demonstrated or discussed, 77 were requisitioned by the Pacific Theaters. The following were considered most suitable for operations: Concrete Piercing fuze; Trailing colored smoke rifle grenades; Adapter for firing chemical grenades from rifle; 7.2" multiple rocket launcher mounted on medium tank; 4.5" aircraft rockets; Automatic 12 round Navy 4 1/2" rocket launcher; 60 mm. illuminating shell; Short 81 mm. mortar; Tank dozer; Kit for mounting 105 mm. howitzer on DUKW; 15-sec. delay detonator; Weatherproof fuze lighter; W.P. Bazooka rocket; Sign Reproduction Kit; Pack Water Purification Unit; Assault gas mask; Concussion detonator; Track extensions to give increased flotation; New H.E.A.T. round for Bazooka; Luminous markers; Individual demolition sets; Metallizing equipment; Pack type standard demolition blocks.

11. Of the larger caliber rocket equipment demonstrated in the theaters, it was considered that only the aircraft and tank mounted multiple launchers, the single tube jungle launcher, and the Navy multiple launcher for landing craft have immediate operational utility.

Recommendations:

1. Theater requisitions for equipment demonstrated should be approved and filled in accordance with priorities indicated thereon.*
2. For important major operations, the War Department should offer to the theaters additional technical military personnel, to supplement intra-theater "damage analysis" teams.
3. Transfer to Hawaii of the activities of the Joint Army-Navy Board on passage of beach and underwater obstacles is advocated.
4. Training in firing organic heavy weapons from landing craft, by all units likely to be engaged in amphibious operations, should be stressed.
5. The theaters should be furnished with data on terminal ballistics of ammunition and tables for high angle fire (above 60°) of howitzers.*
6. Timely summaries of characteristics of new materiel and additional technical reports should be furnished by the supply services, in sufficient quantities to permit distribution to divisions and supply services.
7. Bull dozers should be not smaller than D7 and should be available on the basis of one per Engineer Construction Platoon.
8. Action should be taken to supply corps and army artillery and ammunition requested by the Pacific Theaters, and to meet prospective demands for additional 4.2" mortars, medium tanks and tank dozers.
9. Consideration should be given by the Ground Forces to replacement of 60 mm. mortars with the short 81 mm. mortar, to increase firepower and simplify ammunition supply.
10. Development of the following types of ammunition and equipment is recommended: Shaped charge bombs, similar to the Japanese 1 KG bomb, to be dropped in aimable clusters; Incorporate white smoke spotting charges in HE

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ammunition; Fuzes for mortar and artillery ammunition that will not function on trees or foliage on the ascending portion of the trajectory; Fuzes and lug-band adapters to permit use of Japanese bombs, (limited quantities already made for the Navy); Illuminating shells for 4.2" mortar*; Long-burning base-ejection colored smoke ammunition for 4.2" mortar; aimable clusters of butterfly bombs suitable for dropping from altitudes of 10,000 - 30,000 feet; Detector for submerged metallic mines and obstacles, with minimum range of ten feet; a guard to prevent damage to propellers, propeller shafts and rudders of landing craft used by Engineer Special Brigades.

11. Investigation of the following is recommended: Shaped charge ammunition for 37 mm. guns, especially the 1,500 f/s gun; Decreasing the delay of the concrete piercing fuze from .05 to .02-.03 seconds*; Elimination of the pyrotechnic display incident to lighting smoke pots; Performance of Army and Navy aircraft rockets and launchers, with object of standardization between the services; Preserving ballistic characteristics of WP ammunition, independent of temperature and storage position; overseas shipment of all ammunition on pellets, suitable for subsequent use in amphibious operations.

12. Development and supply of the following types of ammunition should be expedited: Illuminating and colored smoke projectiles for all mortars and for artillery from 75 mm. through 155 mm.*; Canister for 57 mm. gun, 75 mm. howitzer and gun, 3" gun and 105 mm. howitzer*; New magnesium-body offensive hand grenade (T15)*.

*Action on this item has been initiated.

Claudius H. M. Roberts
Claudius H. M. Roberts
Colonel, Ordnance Dept.

James E. Walsh
James E. Walsh
Lt. Col., Corps of Engineers

Harry S. Turner, Jr.
Harry S. Turner, Jr.
Major, Ordnance Dept.

ITINERARY

	<u>Departure</u>		<u>Arrival</u>
1 Feb	1905 Washington, D.C. (via UAL)	1 Feb	2300 Chicago, Ill.
	2315 Chicago, Ill.	2 Feb	0530 Denver, Colo.
2 Feb	1035 Denver, Colo.		1410 Salt Lake City, Utah
	1430 Salt Lake City, Utah		1925 San Francisco, Calif.
	2100 San Francisco (via Govt Car)		2300 Hamilton Field, Calif.
3 Feb	2315 Hamilton Field (via ATC)	4 Feb	0840 Hickam Field, Oahu, TH
			(1000 Reported G-3, Fort Shafter)
5 Feb	(2020 Signed out Fort Shafter)		
	2305 Hickam Field (via ATC)	6 Feb	0810 Canton Island
6 Feb	1040 Canton Island		1620 Mullinix Field, Ella Isl., Tarawa.
	1700 (approx) Ella Isl (via Amphib Jeep and Boat)		1800 (approx) Cora Isl., Tarawa, 7th AAF, HQ
7 Feb	0750 Tarawa Lagoon (via Navy Seaplane-PB2Y3)	7 Feb	1105 Majuro Lagoon
	1405 Majuro		1605 Roi-Namur, Kwajalein
	1625 Roi-Namur		1700 Kwajalein Isl., Kwajalein
(7 Feb:	1800 Reported to Admiral Turner, USS Rocky Mount)		
14 Feb	0845 Kwajalein (S.End)-(via Navy PB2Y3)	14 Feb	0915 Roi-Namur (N.End)
	1700 Roi-Namur (via PB2Y3)		1730 Kwajalein (S.End)
(15 Feb:	0830 Reported to Admiral Hill, USS Cambria)		
15 Feb	1330 Kwajalein Lagoon (via USS Leonard Wood)	17 Feb	0930 Engebi Isl., N.End Eniwetok Lagoon.
19 Feb	0500 (approx) Engebi Isl (N.End) via Leonard Wood	19 Feb	0700 (approx) Eniwetok Isl (S.End Lagoon)

Continued-

<u>Departure</u>			<u>Arrival</u>		
24 Feb	1500	Eniwetok Lagoon (via Navy Seaplane - PBM)	24 Feb	1834	Kwajalein Lagoon
25 Feb	0810	Kwajalein Isl. (via CENCATS plane).	25 Feb	1002	Majuro Isl.
	1040	Majuro		1308	Mullinix Field, Ella Isl, Tarawa.
	1340	Mullinix Field		1350	Hawkins Field, Betio Isl, Tarawa.
27 Feb	0720	Hawkins Field, Tarawa (via NATS plane)	27 Feb	1500	Johnson Island
28 Feb	0715	Johnson Island	28 Feb	1238	John Rodgers Field, Oahu, TH
				(1400	Reported G-3, Fort Shafter
2 Apr	(0120	Signed out at Fort Shafter)			
	0625	Hickam Field (via ATC)	2 Apr	1615	Canton Island
3 Apr	0248	Canton Island	3 Apr	0705	Nanumea, Ellice Islands.
		(Crossed Int. Date Line - Date becomes 4 April)			
4 Apr	0900	Nanumea Island	4 Apr	1435	Guadalcanal, Carney Field.
5 Apr	0638	Guadalcanal	5 Apr	1145	Port Moresby, New Guinea
	1335	Port Moresby		1805	Townsville, Australia
6 Apr	0645	Townsville	6 Apr	1100	Brisbane, Amberley Field
		(6 Apr: 1500 Reported to AGO, GHQ, SoWesPac)			
10 Apr	0605	Archer Field, Brisbane	10 Apr	1010	Townsville
		(via DAT).			
	1100	Townsville		1450	Port Moresby, New Guinea
11 Apr	0815	Port Moresby	11 Apr	0905	Dobodura
	0930	Dobodura		1040	Nadzab
	1115	Nadzab		1150	Finschhafen
		(11 Apr: 1210 Reported to AGO, HQ Sixth Army)			
13 Apr	1020	Finschhafen	13 Apr	1100	Cape Gloucester, New Britain

Continued--

	<u>Departure</u>		<u>Arrival</u>
	1130 Cape Gloucester	1320	Momote Field, Los Negros, Admiralty Isls
(13 Apr: 1400 Reported to CG, First Cav. Div.)			
14 Apr	1510 Los Negros	14 Apr	1640 Cape Gloucester
	1710 Cape Gloucester		1740 Finschhafen
16 Apr	1115 Finschhafen	16 Apr	1215 Dobodura
	1230 Dobodura (by Govt Car)		1330 Cape Sudest, Navy Landing
(16 Apr: 1400 Reported to Rear Admiral Feheteler, USS Blue Ridge)			
	1700 Cape Sudest, (by Govt Car)		1800 Oro Bay (Base Ord & Engr)
17 Apr	1230 Oro Bay (by Govt Car)	17 Apr	1300 Dobodura
	1430 Dobodura (via DAT)		1530 Goodenough Island
	1555 Goodenough Island		1645 Gili Field, Milne Bay
(17 Apr: 2145 Reported to CG, Sixth Div., Hihilai)			
19 Apr	0550 Gili Field, Milne Bay	19 Apr	0730 Port Moresby
	1510 Port Moresby		1915 Townsville, Australia
19 Apr	1957 Townsville	20 Apr	0015 Archer Field, Brisbane
20 Apr	0740 Amberley Field, Brisbane (via ATC)		1415 Guadalcanal, Carney Field
21 Apr	0805 Guadalcanal, Henderson Field (via SCATS)	21 Apr	1155 Espiritu Santos, New Hebrides
	1250 Espiritu Santos		1404 Efate'
	1430 Efate'		1635 Tontuta Field, Noumea, New Caledonia
(22 Apr: 1000 Reported to CG, USAFISPA)			
30 Apr	0820 Tontuta Field, Noumea	30 Apr	1025 Efate'
	1052 Efate'		1158 Espiritu Santos
	1255 Espiritu Santos		1700 Guadalcanal
(30 Apr: 1800 Reported to CG, USAFISPA Advanced)			
8 May	0738 Guadalcanal, Henderson Field	8 May	1130 Espiritu Santos

<u>Departure</u>		<u>Arrival</u>	
1220	Espiritu Santos	1520	Tontuta Field, Noumea
(9 May: 0830 Reported to CG, USAFISPA)			
12 May 0840	Tontuta Field, Noumea,	12 May 1140	Espiritu Santos
(via SCATS)			
1227	Espiritu Santos	1610	Henderson Field, Guadalcanal
13 May 1015	Guadalcanal (via NATS)	13 May 1335	Gili Field, Milne Bay, N.G.
(13 May: 2100 Reported to CG, Sixth Division)			
20 May 1333	Milne Bay (via DAT)	20 May 1420	Milne Bay (started for
Finschhafen, but turned back by weather)			
21 May 0557	Milne Bay (via DAT)	21 May 0810	Finschhafen
(21 May: 1000 Reported to CG, XI Corps and CG Sixth Army)			
28 May 0558	Finschhafen (via DAT)	28 May 0958	Wakde Island
1700	Wakde (via LCVP)	1800	Sarmi-Maffin Bay Beachhead
(28 May: 1830 Reported to CG, 6th Army Task Force)			
29 May 0800	Maffin Bay (via LCVP)	29 May 0900	Wakde Island
1130	Wakde Isl. (via DAT)	1223	Cyclops Field, Hollandia
(29 May: 1500 Reported to CG, 24th Division)			
30 May 1024	Cyclops Field, Hollandia	30 May 1415	Finschhafen, via Wewak
31 May 0912	Finschhafen (via DAT)	31 May 1058	Port Moresby
1 June 0750	Port Moresby	1 June 1157	Townsville, Australia
2 June 1145	Townsville	2 June 1415	Rockhampton
1448	Rockhampton	1700	Brisbane, Archer Field
(3 June: 0900 Reported to GHQ, SoWesPac)			
9 June 0710	Brisbane (via DAT)	9 June 1006	Sydney
13 June 1417	Sydney	13 June 1715	Brisbane
(25 June: 1500 Signed out at AGO, GHQ)			
25 June 1745	Amberley Field, Brisbane	25 June 2208	PDG, New Caledonia
(via ATC)			
26 June 0045	PDG, New Caledonia	26 June 0451	Nandi, Fiji Isls.
(Crossed Int. Date Line - Date becomes 25 June)			

<u>Departure</u>		<u>Arrival</u>
25 June 0708	Nandi, Fiji Isls	25 June 1345 Canton Island
1558	Canton Island	26 June 0121 Hickam Field, Oahu, T.H.
(26 June: 0900 Reported to CG, USAFICPA).		
28 June 0430	Hickam Field (via ATC)	28 June 1855 Hamilton Field, Calif.
2100	Hamilton Field (via Govt Car)	2200 San Francisco, Calif.
(29 June: 1000 Reported to SFPOE and SF Ord. Dist.)		
29 June 1815	San Francisco (via UAL)	29 June 2310 Rock Springs, Wyo.
30 June 0027	Rock Springs, Wyo.	30 June 0447 Omaha, Neb.
0612	Omaha, Neb.	0830 Chicago, Ill.
0940	Chicago, Ill.	1420 Washington, D. C.
(1 July: 0900 Reported to CG, ASF, War Dept.)		

Data on Personnel of Missions

Col. Roberts and Lt. Col. Walsh covered entire itinerary.

Maj. Frescoln and Capt. Williams followed above itinerary from 1 February through 28 February, then returned to U. S. from Honolulu during March.

Maj. Turner arrived in Honolulu 12 March, proceeded to Noumea, New Caledonia on 6 April, and followed above itinerary from 30 April through 30 June.

Maj. Bolster and Sgt. Sohnrey followed a somewhat different itinerary, but were with the mission at Honolulu, Noumea, Guadalcanal, and Finschhafen.

SUMMARY OF ACTIVITIES

1-7 Feb	En route Washington, D. C., to Kwajalein Atoll.
7-15 Feb	Damage Analysis Studies at Kwajalein Atoll.
17-24 Feb	Capture of and Damage Analysis at Eniwetok Atoll.
25-27 Feb	Damage Analysis Studies at Tarawa Atoll.
29 Feb-15 Mar	Preparation of Report on Marshalls Operations.
28-29 Mar	Demonstration of New Weapons at Oahu, T. H.
31 Mar-1 Apr	USAFICPA Conferences on Requirements and Requisitions.
2-6 Apr	En route Honolulu to GHQ, SWPA
6-9 Apr	Conferences at GHQ relative to Marshalls Operations and preliminary arrangements for SWPA Demonstrations.
11-18 Apr	Conferences at Sixth Army HQ and with Sixth Army Units and Navy relative to Marshalls Operations and projected Hollandia operation; preliminary arrangements with Sixth Army HQ and Sixth Div. for Demonstrations.
13-14 Apr	Study of Japanese defenses and weapons in Admiralty Islands and Conferences with First Cav. Div.
19-21 Apr	En route HQ Sixth Div. to HQ, USAFISPA.
28-29 Apr	Demonstration of new weapons at Noumea, New Caledonia.
6-7 May	Demonstration of new weapons at Guadalcanal.
9-12 May	USAFISPA Conferences on Requirements and Requisitions.
18-19 May	Demonstration of new weapons at Milne Bay - (Sixth Div.)
24 May	Demonstration of new weapons at Finschhafen - (Sixth Army and XI Corps.)
25-27 May	Conferences on Requirements and Weapons with Sixth Army and XI Corps.
26 May	Inspection of Japanese defenses at Sattelberg.

Continued-

SUMMARY OF ACTIVITIES

28-30 May Inspection of Japanese defenses at Wakde Island and Hollandia, visit to front at Sarmi-Maffin Bay Beachhead, witnessed bombing of Japanese defenses at Wewak.

31 May-2 June En route New Guinea to GHQ, SWPA

3-8 June Conferences at GHQ, USAFFE and USASOS relative to Weapons and Requirements; visited Ord. Intel. and Navy MEIUW. on Japanese Ordnance.

10 June Visited Australian Camouflage School, Georges Heights, Sydney.

12 June Visited Australian School of Military Engineering, Liverpool, near Sydney, on Engineer and Shaped Charge Investigations.

17-24 June Conferences at GHQ and USAFFE relative to Weapons, Requirements and Requisitions.

21 June Lecture and movies on Marshalls Operations at O.C.S. School, near Brisbane.

25-30 June En route GHQ SWPA to Washington, D. C.

26-27 June Conferences relative to weapons, operations and requirements at HQ, USAFICPA, Fort Shafter.

29 June Conference at SFPOE (Lt. Col. Markert) relative to "ROS" Requisitions for CPA, SPA and SWPA.

30 June Arrived Washington, D. C.

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Damage Analysis

G-3, GHQ

DC/S, USAFFE

15 June 1944

(Thru: CG, GHQ - for information
AG, GHQ - for dispatch)

1. Reference is made to OPDIB, Volume I, Number 7 dated 10 April 1944 which referred to the Roberts Report entitled "Marshall Islands: Japanese Defenses and Battle Damage" and urged that arrangements be made in advance of each operation to have competent observers make an analysis of damages sustained immediately after witnessing the operation.
2. This subject was recently discussed with Colonel Roberts and Sixth Army representatives and G-3 Sixth Army (Colonel Bird) requested that a communication be sent to that command outlining the mission and other pertinent facts regarding a damage analysis team.
3. Enclosure 1 consists of notes taken during conversations with Colonel Roberts on this subject.
4. It is requested that a letter be dispatched to Sixth Army in accordance with their suggestion with a request that that Command make the necessary arrangements to have competent observers on future operations to report on damage analysis.
5. Request that copies of letter as dispatched to CG, Sixth Army be furnished G-3, Engr O, and AG, GHQ.

S. J. C.

1 Incl:
Notes taken during discussions
with Col. C. H. M. Roberts,
Ord., War Department

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Continued--

SUMMARY OF ACTIVITIES

28-30 May Inspection of Japanese defenses at Wakde Island and Hollandia, visit to front at Sarimi-Maffin Bay Beachhead, witnessed bombing of Japanese defenses at Wewak.

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25-30 June En route GHQ SWPA to Washington, D. C.

26-27 June Conferences relative to weapons, operations and requirements at HQ, USAFICPA, Fort Shafter.

29 June Conference at SFPOE (Lt. Col. Markert) relative to "ROS" Requisitions for CPA, SPA and SWPA.

30 June Arrived Washington, D. C.

Notes taken during discussions with Colonel C. H. M.
Roberts, Ord., War Department

Subject: Damage Analysis.

Reference: Volume I, Number 7, 10 April 1944.

"The value (of damage analysis) to other theater commanders is manifest. It is urged that arrangements be made in advance of each operation to have competent observers on the spot and thoroughly briefed so that they may begin their analysis immediately after witnessing the operation. If promptly forwarded to the War Department, copies can be distributed to other theaters or OPD can extract the meat for dissemination through OPD".

1. Mission of a damage analysis team.

To appraise and evaluate "the effectiveness of Army-Navy weapons and munitions and those of the enemy, both during and following operations; to study the types of enemy defenses and suitability of the munitions employed against them; to investigate malfunctions of weapons and ammunition; and to collect miscellaneous technical data of value for developmental or operation use" (quotation taken from page 1 of the booklet "Marshall Islands Japanese Defenses and Battle Damage" dated 1 March 1944 which was prepared by a group headed by Colonel Roberts).

2. Personnel recommended for a damage analysis team.

- a. One (1) Ordnance Officer - thoroughly familiar with proving ground operations to be able to evaluate the effects of:
 - (1) Various types of friendly and enemy ammunition, both Army and Navy, including fuzes.
 - (2) Friendly and enemy ordnance.
 - (3) Damage on concrete and other types of fortifications.
- b. One (1) Engineer Officer - familiar with the design and disposition of fortifications and their tactical significance. Be able to appraise the enemy plan of fortifications, including shore, beach and underwater obstacles and mines. Qualified to reproduce the design of fortifications and to evaluate the character, strength and effectiveness of enemy fortifications and prepared structures. Be able to appraise both friendly and enemy methods and effects in the use of demolitions.
- c. One (1) Chemical Warfare Officer - To appraise operational and tactical utility of friendly and enemy Chemical Warfare Materiel. Evaluate the advantages of smoke if used, or the advantages that could have been attained by its employment. Examine and evaluate enemy CW Materiel, state of preparedness, and tactical employment of flame throwers.
- d. One (1) Enlisted Man - qualified photographer. Be able to photograph objects in such a manner that the pictures will clearly show those features which it is intended to illustrate.

- e. One (1) Enlisted Man - qualified design draftsman. Should have some knowledge of surveying. Be able to make field sketches from which draftings to dimensions will later be made.

3. Navy coordination.

On Amphibious Operations when there is material dependence on naval gun fire both prior and subsequent to the landings, it would be highly desirable for the Damage Analysis Team to have close liaison with the Gunnery and Bombing Officers of the Naval Task Forces. In this way, valid conclusions and recommendations may be reached concerning the performance and types of naval fire and ammunition most suitable and feasible for future operations.

4. Miscellaneous comments.

- a. All officer members should be familiar with the preparation and writing of technical reports.
- b. The team should be thoroughly briefed prior to the operations, and this briefing should particularly include complete information on all phases of the projected operation, plans for air, naval, and land bombardment, artillery and rocket support, types of fuzes and ammunition to be used, etc.
- c. The damage analysis team should consist of the same individuals from one (1) operation to another so that the experience gained initially can subsequently be used to advantage. If this is not feasible, at least one (1) of the senior officers should carry over from one (1) operation to the next.
- d. The booklet on the Marshall Islands referred to in paragraph 1 above may be used as a guide for the preparation of reports by a damage analysis team.

PASSAGE OF OBSTACLES IN LANDING OPERATIONS

Obviously there are two general conditions of defense affecting the technique of beach assault; viz. (1) a weakly held hostile shore without strong defenses and obstacle installations; and (2) a powerful defensive installation of weapons and pillboxes, supplemented by a strong obstacle installation above and/or below the waterline.

Necessarily the first condition is the desirable one, and our commanders are committing their forces in the Pacific against such beaches, because they strategically outguess the Japanese as to the point of attack. Occasionally the other condition is met, as in Normandy and at Tarawa, and we must be prepared to overcome it. In island operations particularly, we are more apt to have to attack frontally through beach and underwater obstacles, because of the smaller stretches of coast line which the enemy must defend. On large landmasses, where hundreds or even thousands of miles of coast must be defended, there is much more chance of being able to bypass strong defenses.

However, since the War in the Pacific is to be an amphibious war, we must be prepared to meet and overcome mines and tetrahedrons in the water and barbed wire, mines and tank obstacles ashore.

Tarawa in the Gilbert Islands had numbers of concrete tetrahedron obstacles emplaced on the coral reef in shallow water. These were supplemented by the use of underwater Japanese hemispherical anti-boat mines, total weight about 100 pounds of which 47 pounds is high explosive. Japanese scaffolding obstacle fences of coconut logs also existed on the coral reef. Furthermore, barbed wire emplaced within the tidal range was sited for covering machine gun crossfire from pillboxes along the shore. Photo No. 22 is a general view of offshore obstacles at Tarawa, with barbed wire in the foreground and concrete tetrahedrons and log scaffolding visible in the background.

Parts of Japanese underwater mines have been seen in storage at Eniwetok and Kwajalein, and aerial photographs have shown installations of concrete tetrahedrons in the water offshore at Wotje and Nauru, two of the bypassed

Japanese Marshall Islands. However, no operation up to June 1944 has encountered underwater anti-boat mines or other water obstacles to small landing craft in the Pacific, other than at Tarawa in CPA. In SWPA, information from G-2, GHQ was to the effect that no Japanese underwater obstacle installations had been encountered in that theater. However, some 250 of the hemispherical anti-boat underwater mines were found in storage on Manus Island in the Admiralties. Mines, horns and batteries were seen, but no detonators or boosters. None of these mines had been placed in water. Thus evidence of their existence has been found, to our knowledge, on Tarawa, Kwajalein, Eniwetok, and the Admiralty Islands. Because of the existence of the Japanese mines for water placement, we must develop an adequate technique of passage of underwater mines. Otherwise we may eventually have a catastrophe.

No concrete tetrahedrons have been encountered other than at Tarawa, although photographic evidence of their existence at other Marshalls Islands has been noted. A captured Japanese document in SWPA indicated that their planned size was 2.2 tons, corresponding to 27 to 30 cu. ft. volume, which again indicates that preparation and construction of such obstacles to amphibious assaults is a matter of policy and not an isolated instance peculiar to Tarawa.

G-2, GHQ unofficially stated that their combat experience was confined almost exclusively to movement through the New Guinea jungle, that their landings have been practically unopposed, so that their experience has not brought them up against any real opposition in amphibious landings as yet. (This was prior to the Wakde operation).

A talk was had with Colonel Sturgis, Sixth Army Engineer, and with his executive officer, Colonel Ely. Colonel Sturgis said that no special training has been carried on with regard to the possibility of encountering obstacles in the water in SWPA amphibious operations. This was because the Engineers had been so pressed with other work, particularly construction. However, the underwater mines on Manus Island brought the necessity of preparation sharply to the attention of the local staffs. Sixth Army plans to do some work along this line in the future.

Conference with Colonel Mills, Task Force Engineer for the Hollandia

operation, and with Colonel Lauterbaugh, C. O. of 116th Engr. Bn., the divisional Engineer troops of the 41st Division, disclosed the fact that no adequate preparation for removal of underwater obstacles had been made or contemplated for that operation.

It was planned to bomb the assault beach both in the water and on the land just prior to the landing. The landing craft were to be about 800 yards offshore when the bombs were dropped. The coxswains were then to steer their craft for the center of the bomb hit most directly to their front. There were to be no Engineers or other demolition troops in the first wave. Shore party Engineers were to come in with the third wave, to run dumps and process supplies across the beach.

In a conference with Admiral Fecheteler, who commanded the Naval Task Force for the Hollandia operation, we discussed the tactical feasibility of having our ships enter the harbor to place the Army on the beach close to the objectives. For clearance of possible underwater mines close inshore, destroyers were to shell the offshore waters with 5" H.E. in an effort to countermine any of the mines which might be present. We do not consider this method very practicable.

The best intelligence indicated that no obstacles would be met, because the Japanese were themselves using the harbor and beaching landing craft therein. Two Naval demolition units were to go along on the operation. These men had been trained in the elimination of underwater obstacles by use of explosives. However, plans included no provision for use of this personnel.

A discussion of the methods of passing possible obstacles in the Hollandia operation resulted in Colonel Sturgis' asking for a memorandum on the matter, which is reproduced below:

12 April 1944.

MEMORANDUM TO: Colonel Sturgis, Sixth Army Engineer.

1. As a result of conference with 116th Engineer Battalion, it appears that air bombing is the only means contemplated for removal of underwater obstacles. No engineer troops are being used in the assault waves. (Hollandia operation).

2. Since obstacles must be removed if encountered, it is felt that the Navy demolition units and the Engineer special Brigade personnel must be welded into a team in conjunction with demolition parties from Engineer units.

3. It is essential that men be trained in the tactical approach to obstacles both on the beach and in the water. Men proposed for underwater demolition should be trained to waterproof their demolition material. They should practice the placement of charges in surf and current conditions, which tremendously handicap the movements of demolition personnel.

4. It is believed essential to organize and train such underwater demolition personnel in close conjunction with landing craft personnel. It should be a joint enterprise.

5. In experimentation, it has not been feasible to bomb underwater obstacles out of the way. A 100-lb bomb (general purpose, 50-lbs of explosive) with tail fuze or short delay nose fuze, can countermine Jap mines to a radius of 20 to 25 feet. The difficulty will be in hitting the obstacles. Clearance will be only a remote chance.

6. The only practical use of bombing has been the testing of 100-lb general purpose bombs with instantaneous fuzing dropped by intervalometer spacing at 5 to 8 feet on centers; this bombing has been effective in clearing barbed wire. Land mine installations have not been cleared very effectively. Therefore, it is believed that underwater mines will not be cleared either.

7. It is recommended that 5 man underwater demolition teams be trained on the basis of 6 to 8 teams per Battalion landing beach.

8. Materials available for such training are:

- a. Waterproof Fuselighters - M2.
- b. Concussion Detonators.
- c. Aquatic Snakes.
- d. Standard Demolition Materiel.

J. E. WALSH,
Lt. Col., CE.

In the Pacific theaters there has been no operational use of methods of passing obstacles. Nevertheless, definite indications exist that the problem will be encountered in future operations. CPA is training demolition personnel and developing technique at a center on Maui to counter this most dangerous enemy capability. SWPA has not taken any really active measures as yet.

The experimental work being conducted by the Joint Army-Navy Board on Underwater Obstacles at Fort Pierce and by the Corps of Engineers at the same location, should be completely oriented toward the Pacific theaters. In this connection, consideration should be given to closer integration with the work being done in CPA. It might even be desirable to conduct this work in Hawaii, because of the closeness of that location to operational conditions and experience. Actually, conditions at Fort Pierce do not approximate those encountered in Pacific operations. For instance, barbed wire will not remain in place in the

surf and loose sand at Fort Pierce for longer periods than 4 to 6 days, whereas Japanese barbed wire has remained in place on steel pickets set in coral at Tarawa for as long as four months, with 60 - 70% of the wire effective at the end of that period. Also, such a tool as the Reddy Fox aquatic snake (Mk 13 Navy Demolition Charge) creates lips of sand above the water when detonated on the sandy beaches of Florida, whereas on coral in the Pacific no such lips are formed. The extremely clear, warm, and calm water of the Pacific islands greatly affects the feasibility of hand placement of explosive charges, as compared with water conditions for the same type of work in Florida.

If the mission of the Joint Army-Navy Board is to solve the underwater obstacle problem in this war, the time has come to place the emphasis on means now available, and be certain that our units are trained in their use. From this point of view, the Board should work on technique of removal as well as development of new devices. This work will more directly help our operations if conducted on the Pacific coast or in Hawaii, where units are staged to the Pacific theaters.

It is our opinion that the materials now available will be used throughout this war, and that the best technique of their use is the most profitable contribution that the Joint Board can make to the war effort from this time on.

Further technical development must be done by the Army and Navy development agencies who are supplied with funds and facilities. The Joint Board uses these facilities through those agencies, which must continue to work on specific development projects. We feel that the indoctrination of our training centers and of the units processed through them is the most important problem before us and that this work can best be done at locations where the units are processed.

Such a step would change the primary function of the Board from development of equipment, wherein they have always merely considered items produced by the technical services, to the technique of use of these items and the training of units therein. Of course Navy demolition units are trained at Fort Pierce, but the main amphibious effort is in the Pacific and the accent on this training has been transferred to the Pacific Coast.

If the premise be granted that use of means now available is the most pressing need, we believe it inescapable that technique indoctrination at staging areas for the Pacific theater will be the most productive utilization of the personnel of the Joint Army-Navy Board.

It is felt that intensive experimentation and development in methods of passing underwater obstacles should continue, as should development work in all other military lines. However, Fort Pierce is close to the established facilities and manufacturers, whereas Hawaii is close to the real operational problem. The war theaters cannot be moved. Fort Pierce activities must then move to the Pacific, either bodily or by continuous personal contact of Army-Navy Board personnel with theater and amphibious training centers.

As a result of having been in the theaters of war and being somewhat familiar with the course of development work at Fort Pierce, the following comments and critical appreciation of the means and tools experimented with there is offered.

The problem of passing obstacles in landing operations is a very broad one, almost analogous to the solution of such a problem as how to fight and win a war. It is extremely hard to gather together a committee or board and, in effect, ask them to formulate ideas to solve so general a problem. Specific developments desired by the fighting troops can be met by the Technical Services, but the creation of new tools in such a wide field as the passage of obstacles is infinitely more difficult. It requires the viewpoint of the fighting arms and the visualization of specific needs. For instance, the Japanese hemispherical underwater mine is a specific enemy tool. The Joint Army-Navy Board could initiate action to develop a metallic mine detector for use underwater which can be carried easily by one man, who must also carry an explosive device to destroy the mine. This detector must enable the man to find such a metallic mine in the murky water which results from impacts of shells and bombs. Its range should be perhaps 10 feet. The countermeasure might be the clip-type charge of primacord which CPA developed to place on the horn of the mine and thus destroy it by detonation from a 20-minute delay fuze.

Another suitable problem might well be the problem of placing an aquatic snake paravanned out from the side of an LCVP, and this problem has been worked on for some time. Means must then be utilized to educate theater operational personnel to use this tool, if considered worthwhile. A trained crew must go to the theater to show operational personnel how the tool can contribute to the more successful prosecution of the war. The Joint Board's work will bear fruit only if this is done.

In the theaters, simple means of passage of obstacles are preferred. A task force commander must weigh the value of each man and each piece of equipment in the light of what accomplishment he or it can contribute to the success of the operation. Space on transports and landing craft is very carefully apportioned and each man or item must definitely be necessary. No infantryman, artillery crew, construction man, or naval beach party can be sacrificed for special personnel unless the obstacle-man is more essential.

Based on the results of reconnaissance missions by Navy personnel at Kwajalein and at Eniwetok, it does appear practical to clear obstacles by hand-placement of explosives under cover of naval bombardment. Periods as long as 10 to 20 hours might be required for adequate clearance, depending upon the extent of the enemy obstacle installation and the adequacy of the covering fire. It is understood that 2 days were required for obstacle clearance on the invasion beaches of Normandy, although plans had allotted only 20 to 30 minutes for that purpose.

Work in daylight will allow much greater efficiency of operation, and against Japanese defenses in the islands of CPA would definitely be feasible. Prerequisites are air superiority and preponderant naval fire support to prevent enemy interference with the obstacle removal operation. It is, of course, desirable to have a beachhead before having to do extensive demolition work, but overwhelming fire support can allow successful obstacle removal under fire.

It is felt that the best procedure usually will be to nibble out three or four passages through a line of obstacles on each battalion landing beach and then gradually to clear the entire beach. The necessary width of gap will

depend on the surf and hydrographic conditions, as well as on the relative location of the beach and obstacle line. Generally the width of a breach must be twice or more the length of the landing craft to allow retraction of the craft. In the Pacific, broaching of landing craft on hostile shores has not been as great a problem as in the rougher waters of the Atlantic.

Of the tools developed and experimented with at Fort Pierce for the passage of underwater obstacles by hand placed explosives, the weatherproof fuze-lighter M2 and the 20 lb. packs of Tettrytol, (Block Demolition M1 and M2) are well-nigh indispensable. They are considered standard for use in CPA at the present time, and their placement by hand by personnel operating from small boats is considered at this time to be the only certain method of eliminating obstacles in the water. In this opinion, we concur.

The concussion detonator in its present form is a valuable adjunct to hand placement of underwater charges and, since it has gone into limited production, intensive efforts should be made to get it into the hands of Naval Demolition Units and into Engineer explosive stocks in all theaters. The safety feature with salt tablet delays of $3\frac{1}{2}$ or 7 minutes is intended to provide for safety of handling personnel. However, it is felt that these times are too short, particularly since they must be reduced by up to 50% as the salt tablet dissolves, thus making the device dangerous after $1\frac{3}{4}$ minutes for the $3\frac{1}{2}$ minute delay. Reference is made to CPA practice of having fuzes cut to lengths of as much as 20 minutes. In our opinion the salt tablet dissolving time should be 7 minutes and 15 minutes. Many different ideas as to time could be presented, but certainly the present delays are too short. The lack of complete control by the attacker of time of detonation of a charge is a disadvantage, in that bombardment can detonate our charges, but it is felt that the positive advantages of the device outweigh this limitation since it eliminates the necessity for elaborate interconnection of charges.

The aquatic snake can be a valuable adjunct to hand placed charges in clearing underwater obstacles. It can be used to lower channel depths on coral reefs and can disintegrate most substantial obstacles in an area 30 feet wide

and 60 feet long. This is predicated on a standard 50 foot length of charge with 30 lbs of explosive per foot of length. The effect of the explosive is known when close placement can be made, but it is felt that only superbly-trained crews could use the charge to advantage. This puts the future of this tool squarely up to the Navy, which controls the use of landing craft. Apart from the immediate beach problem, the Navy must decide whether they can transport this 50 foot charge on transports or other craft from our bases to the scene of an amphibious assault. No adequate provision has yet been made to implement this necessary stage in the operational use of this tool. For instance, only 18 foot lengths of aquatic snake were taken on the Marshall Islands operations. The Reddy Fox is the outstanding alternative to hand placement of explosives, and because of that fact, it is worth a strong effort to use the tool operationally. We believe that the tool is developed to a usable stage, that placement is a matter of training (and perhaps this feature makes the tool of little value), and that use in operations only can decide the value and future of this charge.

Attachment of a torpedo (Mk VII and possibly Mk XIII Type) to the tail of the Reddy Fox to allow projection from 2000 yards offshore is indicated as practicable in reports of recent work at Fort Pierce. However, the necessity of incorporating radio control to sink and detonate the charge in the proper location, and the chance that the charge will not hit the desired portion of the beach, leads to the conclusion that this means is excessively complex; that some time will be required to work out the method, thus eliminating the possibility of early use (probably not in this war); and that hand-placed explosives still will have to be used to be certain of obstacle clearance.

A simple bumper device for attachment to landing craft to allow passage of underwater obstacles has been developed. Made of 5 inch pipe, wedge shaped, and mounted to the hull by side brackets on which it can be pivoted, with a stop to hold the bumper about 12 inches below the boat's bottom, this idea is worth immediate dissemination throughout the war theaters. Pictures, drawings, and test results should be included. Admittedly such a device will not be a panacea for obstacles of all types, but the simplicity and field feasibility

of installation and use make it of immediate value, especially in the Pacific. Tests should be made to determine feasibility of landing tanks, artillery and other equipment from bumper-equipped boats, to determine effects of possible interference between bumper and vehicle, under conditions of both hard and soft bottom. Apex Boats overconcentrate a large charge of explosive, so that the effect on a line of obstacles is quite localized. The Reddy Fox charge, although itself inefficient as regards explosive charge, is much better in this connection than an explosive boat. However, the Apex boat is available, has been present on a few operations, e.g. Sicily, Kwajalein, and can place a charge without exposure of personnel. It has never been used operationally, has in fact been a danger (for instance, an Apex boat got out of control in the transport area at Kwajalein), and will necessarily have to be followed by hand placement methods. It is believed, however, that the method is a desirable auxiliary to have available. These boats should be used operationally. In addition to their effect on water obstacles, detonations offshore will adversely affect the morale of the defenders.

The Radio Detonator lacks the primary military characteristic of simplicity of operation and use. It would require the use of specially qualified and trained personnel, as well as high quality of technical field maintenance. It is believed that it could be used, but is unnecessary. For use with hand-placed charges, the personnel will have had to go in to the obstacles anyway and may as well initiate the explosion at that time. The Apex boat needs no radio detonator, because it now has one. A conceivable use would be with a Reddy Fox charge with self-contained propulsion, to permit detonation at the proper time and place. As previously stated, it is not believed that the present situation with regard to this development will allow utilization of such a method in this war.

Aerial bombing has been and is being experimented with by the Joint Army-Navy Board to destroy underwater mines and barbed wire, but such experiments have not demonstrated that dependable results can be attained. Furthermore, this use of aerial bombardment is dependent upon time of day, weather conditions and enemy air or antiaircraft activity. Nose-fuzed 350 lb depth bombs,

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Mk 47, and 100 lb GP bombs, fuzed instantaneous in nose and tail are recommended by the personnel at Fort Pierce. It has been mentioned that such bombing was contemplated for the Hollandia operation. We doubt that bombing can be depended upon to contribute reliably^{to} and a tactically valuable extent in clearance of underwater obstacles. (This statement should not be confused with clearance of obstacles on the beach).

Against beach obstacles such as barbed wire, concrete blocks, concrete walls, log obstacles, etc., hand placed charges are again the most reliable and effective means of removal and have been investigated in detail. Under favorable conditions, aerial bombing is also reasonably effective for removal of such obstacles as barbed wire and mines.

Mechanical means are of course desirable adjuncts or alternatives. The medium tank-dozer is an outstanding contribution to obstacle passage technique for removal of small semi-portable obstacles and barbed wire, and for ramping over larger obstacles.

The T40 rocket launcher is believed to be more valuable as an assault weapon than as a means of breaching obstacles. It will effectively demolish small pillboxes. It requires increased accuracy, increased range, and a simplified fire control system to be a completely acceptable weapon. The rockets themselves should be filled with an explosive insensitive to gunfire, including tracer ammunition, and the rocket fuzes should be more dependable.

The development of an Engineer Armored Vehicle (M4 Medium Tank) for protection of assault demolition personnel is believed to be valuable for the European Theater, particularly for Engineer Troops attached to tank organizations. There is no need for such equipment in the Pacific at present. Of the items in the proposed accessory kit: the dozer blade is very valuable; the side doors are necessary; the T40 launcher for demolition rockets can be valuable for use in special situations; an attachment (Doozit) for mechanical placement of an explosive charge against a wall is of doubtful utility; use of a trailer behind the tank will handicap its maneuverability and is considered unwise. A compromise vehicle cannot fulfill all purposes and too many attachments will

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complicate the device to such an extent as to limit its utility for all purposes.

CONCLUSIONS:

1. The presence of underwater obstacles on a strongly defended beach can seriously prejudice the success of an operation. Their detection should be a primary objective of aerial photography and reconnaissance.
2. Water obstacles should be one of the most important considerations with regard to choice of the time of an amphibious operation, especially with reference to tide. They should be dealt with "in the dry" if possible.
3. Underwater obstacles can be removed by hand under the protection of overpowering naval gun fire. It is best done in daylight. Its tactical feasibility in an individual case depends upon extent of obstacle installation, surf and weather conditions, and neutralization of defending weapons.
4. Underwater obstacles are now, and probably for the duration of the war will be, most effectively passed by hand placed explosive charges.
5. Waterproof Fuselights M2, Concussion Detonators, 20 lb packs of tetrytol (Block Demolition M1 and M2), and standard demolition accessories are the fundamental and necessary equipment for underwater obstacle passage.
6. The realistic problem is the training of men in waterproofing of explosive circuits underwater and placement of charges in surf, tidal, and current conditions.
7. Boat Bumpers, the Reddy Fox Charge and Apex boats are worthwhile auxiliary, but subsidiary, means of removing underwater obstacles. Their use should be exploited and when suitable they should be used operationally.
8. Rockets and bombs have not been shown to be effective for destruction of underwater obstacles. Sympathetic detonation of underwater mines by rockets and bombs, while technically feasible, is operationally undependable due to difficulty of locating and hitting the mined area.
9. Beach obstacles are most effectively passed by hand methods. A beach-head or fire superiority will allow successful employment of small groups with explosives.

10. Tank dozers are valuable and necessary auxiliaries to use of explosives in removal of beach obstacles.

11. The medium tank with T40 Demolition Rocket Launcher, in addition to its primary utility as a bunker-buster, can be a valuable adjunct for destruction of certain beach obstacles, with minimum exposure of personnel.

12. No need for Engineer tanks has been seen in the Pacific theaters.

RECOMMENDATIONS:

1. Effective steps should be taken to train Army personnel in the best and latest methods of passing obstacles in landing operations. Specifically, hand placement of explosives should be accepted as the best available operational technique. Engineer and reconnaissance troops of all divisions participating in amphibious operations should be thoroughly trained in water-proofing of explosive circuits, hand placement of charges in surf and current conditions, and working from landing craft and rubber boats in surf. This should be done at staging areas, such as Hawaii, or the Amphibious Training Center at San Diego, California.

2. An underwater mine detector, easily portable by one man, should be developed, with the ability to detect metallic underwater mines at a minimum range of 10 feet in 5 feet of water.

3. The Navy Department should be requested to supply at once landing craft (LCM) boat bumpers of the type developed at Fort Pierce, to each of the following agencies:

Amphibious Training Center, San Diego, California

Underwater Demolition Center, CPA

Amphibious Training Center, SWPA.

In addition, one of the boat bumpers should be sent to Aberdeen Proving Ground for tests involving landing and loading of artillery, tanks and other heavy equipment, to determine whether interferences exist.

HEADQUARTERS UNITED STATES ARMY FORCES
CENTRAL PACIFIC AREA
APO 958

S E C R E T
Auth: COMGENTPAC
Init: AGD
Date: 3 Feb 1944

AG 334/71

SUBJECT: Appointment of Board of Officers.

3 February 1944

TO: (See Distribution).

1. B/O is aptd to meet at place designated by and at call of Pres thereof to consider and investigate the following subjects in connection with materiel and ordnance; as well as other matters which may arise during the board proceedings:

a. Increased fire power to be obtained during the landing phase of amphibious operations by firing of self-propelled artillery from LCMs.

b. Methods to be employed in combating off-shore beach and land mines.

c. Need for medium and heavy artillery for reduction of strongly fortified areas which may be encountered in future operations.

d. Special types of ammunition which might facilitate future operations.

e. Possibility of obtaining amphibious tanks armed with 75mm or 105mm guns.

f. The employment of trained Ordnance groups for obtaining data immediately following an engagement as to effectiveness of equipment and weapons used.

g. Possibility of use of grappling hooks fired from 81 mm mortars for clearing wire.

h. Training in, and development of tactical doctrine for employment of 4.5" rockets.

DETAIL FOR BOARD

BRIG GEN REDMOND F. KERNAN JR 0173014 USA 27th Inf. Div. APO 27
COL WILLIAM L. McCULLA 017580 ORD DEPT Seventh AF APO 953
LT COL STEPHEN ROBY 0247561 ORD DEPT this Hq (Ord O)
LT. COL BRUCE B VANCE 0335432 FA 38th Inf Div APO 38
MAJ FRED J SENGSTACKE 0347852 INF this Hq (G-3)
MAJ EDOUARD R L DOTY 0312822 CWS this Hq (Cml O)
MAJ RAYMOND A WILKINS 0195234 FA 7th Inf Div atchd this Hq (HAC)
MAJ JOHN T WEST JR 0330414 INF this Hq (G-4)
CAPT WAYNE C SIKES 0408975 INF 4th Armd Gp APO 957 Recorder

By command of Lieutenant General RICHARDSON:

/sig/

H. S. THATCHER,
Lt. Col., A.G.D.,
Assistant Adjutant General.

NOTE BY CHMR: Lt. R. L. Bart, C.E., later
added to Board.

WAR DEPARTMENT
Army Service Forces
Office of the Commanding General
Washington

26 July 1944

SUBJECT: Training in Disposal of Duds.

TO: Chief of Engineers
(Thru: General Borden)

Observation of operations in the Pacific theaters of war has brought to the forefront the problem of disposal of dud shells and bombs on the battlefield. In North Africa, in the Central Pacific, and in Southwest Pacific, the assigned responsibilities of the various arms and services have not provided an adequate solution to the problem of disposing of the thousands of our own unexploded bombs and shells which cover the area over which we advance.

Engineer troops have in all theaters been called upon to dispose of duds by demolition. Their responsibilities for anti-tank mines and booby traps and training in use of explosives gives them a fair background for such work. However, men should not be called upon to perform a task for which they have not been prepared. Southwest Pacific has been training Engineers in dud-disposal for two years: such training should be given in the continental United States. It could be introduced as part of the training in mines and booby traps. It is believed that some 96 hours are devoted to that subject now in unit-training. The subject should be called "Mines, Booby Traps and Duds," and about eight (8) hours devoted to a few simple principles of the demolition of dud shells and bombs. This work should be limited to demolition in situ of duds. Where an unexploded bomb has to be neutralized or moved, the work should continue to be done by Ordnance Bomb Disposal Units, whose training in details of fuzes and countermeasures to delayed-action bombs qualifies them for such work.

All combat troops need some training in dud-disposal, because duds are a common feature of combat life. However, Engineers need this training particularly because they are called upon for such work continuously, and because their construction activities include clearing areas of duds as a prerequisite to construction.

The need for some training for Engineers in dud-disposal has been discussed with the following agencies in addition to the Office of Chief of Engineers, and copies of this correspondence are being furnished for their information. All these agencies acknowledged the need for such training; they informally indicated approval of incorporation of such training in current programs.

Army Ground Forces, Engineer Section
Col. Hughes, Room 341, Bldg. T-5, Army War College.
Army Air Forces, Engineer Branch
Col. Heiberg, Room 5E-977, Pentagon.
Army Service Forces, Director of Military Training
Col. Trudeau, Room 2E-614, Pentagon.
Chief of Ordnance, Military Training Service
Col. Wagner, Room 3A-478, Pentagon.
War Department - G-3
Col. Adams, Room 2C-935, Pentagon.

RESTRICTED

Ltr. to Ch/Engrs
dtd 26 July 1944
Cont'd.

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In this proposal of training in disposal of duds for all troops, but particularly Engineers, there is no real conflict with the present Ordnance Bomb Disposal Units. The problem of disposal of duds in an operational area is quite different from the problem which Ordnance Bomb Disposal units were designed to solve. This problem was the safe removal or disposition of unexploded or delay-action bombs in a population center such as London. The problem on the battlefield is rather the demolition in situ of duds by placement of explosives. It is a matter that concerns combat troops in about the same fashion as land mines or booby traps. A need will still exist for supplementary Ordnance specialists in bomb disposal for such work as disarming a dud-bomb in a hospital area, where the bomb could not be detonated in place.

It is recommended that about eight (8) hours training in field disposal of dud bombs and shells by demolition in situ be introduced in current training for Engineers, in the subject "Mines and Booby Traps."

James E. Walsh,
Lt. Col. C. E.

SUBJECT: Visit to the Australian School of Military Engineering, Georges Heights and Liverpool, near Sydney, 10 and 12 June 1944.

1. The activities and facilities of the school were explained and shown by Lt. Col. Jelbert, who is the Commandant. He was very cooperative in discussing their engineer instruction methods. The school accommodates about 400 students. The courses vary in length, but the main course is 18 weeks long, devoted almost exclusively to engineer subjects. The subjects are standard, including roads, bridges, heavy equipment, engineer reconnaissance, demolitions, engineer assault tactics, etc. The texts used are standard British War Office Engineer publications. Most of the work is done in the class room, with about a week of field exercises at the end of a course. The students come from civilian engineers who are processed for commissions, and from outstanding personnel in the rank and file. Officers and officer students are given standard basic Infantry training in a separate eight weeks course, as the S.M.E. provides only Engineer instruction. Engineer instruction differs from American practice in at least three factors; first, all officers are given a few days instruction in bomb and mine disposal, which in all British Armies is an Engineer function; second, the Engineers are responsible for Chemical Warfare; third, mapping is not a function of standard engineer troops in Australia, but of a separate branch of the service, The Survey Corps.

2. Lt. Col. Jelbert considered land mine warfare, which we are stressing so much nowadays, as not particularly important in his courses. A few days are allotted to mine field methods, the use of the mine detector, etc. The guiding principle seems to be that a unit must train in a particular theater, and that knowledge of enemy mines should and must be adapted to local conditions of campaign. Therefore, general instructions in this subject can be only quite brief. Furthermore, jungle warfare conditions in the Southwest Pacific have not included many mine warfare problems.

3. One item of Australian standard engineer stores, which appears valuable, is a sectionalized twenty-four (24) inch diameter culvert pipe. These are half cylinders, approximately twelve feet in length and are nestable, with consequent great economy in storage and shipping volume. Lt. Col.

Jelbert said they had been very valuable in New Guinea for road drainage.

4. For beach roadways, the Australians have #3 gauge 3" wire mesh which comes in sections 6' x 10', weighing eighty-four (84) pounds. This has been used very effectively for beach roadways. It has been contemplated also for use in laying air strips, but American pierced plank landing mat is used almost exclusively. This mesh is described in Australian Engineer-in-Chiefs' Technical Instruction No. 46, 14 April, 1944.

5. This Australian wire mesh has been experimented with very successfully as a bridge expedient, as shown in Photo. No. 60. The 6' x 10' sections are joined by a spiral wire connector and drawn by a block and tackle across a ravine to form a simple suspension bridge span. Such a span has been used as an Infantry bridge both in Australia and New Guinea. This bridge will support light vehicles, as evidenced by the demonstration of driving a sedan across a 150' span of this material, its capacity being rated at two tons. When tested to failure, this bridge failed under about a 10 ton load. Similar construction with two thicknesses of this wire mesh has been successfully crossed by a D-4 tractor over a 150' span. Tested to failure, this double bridge failed at 29 tons load.

6. The Australians have a grapnel projected from a 3-inch mortar, similar to our Ordnance development item, shown in Photo. No. 61. They visualize use of this item in throwing line across a ravine or swift-flowing stream so as to enable a man to get across. Under similar circumstances, without such a line, they have lost personnel by drowning in New Guinea. Their grapnel pulls a quarter inch rope rather than a wire cable, it being considered that rope has adequate strength for the purpose, besides resulting in a much lighter unit. Its range is about 250 feet. The quarter inch rope is coiled sinuously in a wooden box so as to unwind easily and allow true flight of the projectile.

7. Their standard bridge is the Bailey bridge, for which they are using American production. They also have a tubular "Steele" truss bridge of commercial design which is now obsolescent.

8. For water supply equipment, they prefer our Mobile Purification

Sets to anything of their own. Their water tank, which is worth mentioning, is a one-piece canvas item, of which the circular top contains a 6" ring of kapok, so that as the tank is filled with water, the kapok floats. The canvas tank assumes a cylindrical shape and stands under water pressure without the use of staves.

9. In demolition work, in addition to training in bomb disposal, they are carrying on some development work on British "Beehive" shaped charges. They are considering them for use primarily in rapid quarrying operations. The functioning of shaped charges was discussed at some length with Major D. Dowie, who is in charge of research at S.M.E. The work done there has consisted chiefly of confirming British and American results, and no original development work has been done. Recently some charges similar to the T3 charge have been built, with difficulties similar to those experienced in CPA, due to use of non-annealed cones.

10. As previously mentioned, there is not a great deal of stress placed upon land mines. However, the Australians do have a very compact Booby Trap Firing Device, capable of multi-purpose use. It will function under pressure, from release of pressure, from pull of trip wire, and even from release of trip wire. Its main advantages are its compactness and flexibility of use, but it is quite complicated and ticklish to use.

11. In heavy equipment the Australians use American made material almost exclusively.

12. Concerning engineer assault technique, the Commandant felt a great need for a means of dealing with Japanese pill boxes at close range. He felt that an apt solution would be something that could be safely used by a man on top of such a pill box, since he claimed that experience had shown that a man could reach such a box and be safer there than he would be at a range of fifty to seventy-five yards. Lt. Col. Jelbert thought the flame thrower was not particularly valuable as an assault tool and that the "Tommy" gun fulfilled the same purpose to better effect.

13. Experiments have been carried out at S.M.E. with firing a 25 m/m

high explosive shell from a rifle grenade discharger. In trials, three shots have been grouped within a twelve inch circle at a range of 100 yards. The Australians felt that this added accuracy over the Bazooka would allow neutralization of Jap bunkers more effectively by placing high explosive rounds through embrasures.

14. The School of Military Engineering conducts a special course in camouflage, with the accent on deceptive tactics rather than concealment. In general, camouflage is considered a subject for unit training rather than school work. Area concealment is rather in disrepute, which is justified by observation of campaigns in New Guinea. Formerly, an Australian Division had a camouflage section of one officer and five men. This was done away with in favor of a camouflage company per corps. However, no such camouflage companies have been approved for activation. Now, the only Australian camouflage personnel are one officer and one sergeant, on divisional and corps staffs, who advise on deception.

15. In response to questions, it was learned that very little night training and very little special jungle work are done at S.M.E. The Commandant considered both to be a matter for unit training.

WAR DEPARTMENT
Army Service Forces
Office of the Commanding General
Washington

31 July 1944

SUBJECT: Sterilization of Water by Oligodynamic Action.

TO: The Surgeon General,
United States Army.

THRU: Commanding General,
Army Service Forces.

1. During a recent visit to the Pacific Theaters, discussions were had with the Commanding Officer, Unit Jungle Training Center, Central Pacific Area, and others relative to the sterilization of water by individuals separated from organizations and forced to rely on their own resources.

2. In this connection, the ability of certain metals, notably silver, to sterilize water by oligodynamic action was mentioned. It was found that no one seemed to be familiar with this action, but there was active interest in the subject, especially in connection with jungle training. It was recommended that no action be taken officially to teach this method until it had been submitted to and approved by the Medical Corps.

3. The oligodynamic action of certain metals, especially silver, in killing bacteria by specific action of ions dissolved from the metal has long been known. Water exposed to prolonged action of silver is not only sterilized but becomes actively germicidal and can sterilize additional quantities of water by dilution. Numerous patents on oligodynamic action of metals have been issued in the last twenty to thirty years and there is at least one commercial organization in this country selling such a process. Within the past five or six years, the scientific aspects and specificity of oligodynamic action have been critically investigated at California Institute of Technology, from which reports of the work can be secured. The work there was done by Dr. Alexander Goetz.

4. It is recommended that this subject be investigated by the Medical Corps with the view to dissemination of information throughout the Army and establishment of training doctrine for use of the method, whose simplicity and the fact that no expendable supplies are required recommend it for consideration.

C. H. M. ROBERTS
Colonel, Ord. Dept.

SECRET

HEADQUARTERS UNITED STATES ARMY FORCES CENTRAL PACIFIC AREA
OFFICE OF THE COMMANDING GENERAL
APO 958

CHMR/cfs

31 March 1944

SUBJECT: Tests of Shaped Charge, 35 lb, T-3.

TO: Commanding General, USAFICPA, APO 958.

ATTN: Engineer Officer.

1. In accordance with instructions, the design and manufacturing requirements for local production of Shaped Charge, 35 lb, T-3 were discussed in detail with personnel of your office, following which a small number of these charges were produced by the Engineer Mill, for comparative tests. Some of the cones were annealed, as is required for proper performance of the charge, while others were not annealed. All charges were loaded with Composition C-2 (plastic) explosive, which is somewhat less effective than the standard pentolite explosive used in the T-3 Charge, but which is the only suitable explosive that is locally available.

2. Tests of the above charges were made at Puu Iki on 28 March, for comparison with the standard T-3 Charges, received on that date by air express from the Ordnance Department. Tests were made against a concrete wall six feet thick, reinforced with $\frac{1}{2}$ inch bars on 12 inch centers, disposed in four mats. The reinforcing used in this wall was insufficient for optimum strength and resistance to shattering, resulting in extensive cracking and shattering due to detonation of the charges. This effect, while undesirable, did not, however, prevent securing reliable results, from which valid conclusions can be drawn.

3. The standard T-3 Charge completely perforated the wall with a hole approximately four inches diameter, accompanied by extensive spalling on both faces.

4. The locally made T-3 Charge with annealed cone penetrated approximately sixty two inches into the wall, forming a hole approximately four inches diameter, accompanied by extensive spalling on the front face. Performance characteristics of this charge were normal in every respect, except as to depth of penetration, but this was due primarily to the lower power of the C-2 explosive. Approximate calculations indicate that the penetration to be expected with this explosive should be about ten to fifteen percent less than with pentolite. Since the standard charge completely penetrated the wall, while the other did not, an exact comparison of their power cannot be made, but it is assumed that the difference was due to the explosive used.

5. The locally made T-3 Charge with non-annealed cone produced the characteristic branched hole obtained with highly stressed cones, whose collapse is non-symmetrical and which do not yield the normal shaped charge effect. Maximum penetration obtained with this charge was approximately thirty two inches, or only about fifty percent of that obtained with an identical charge having an annealed cone.

SECRET

6. Conclusions:

- a. Mechanical details of workmanship, symmetry and loading of the locally made T-3 charges appeared to be excellent.
- b. The locally made T-3 Charge with annealed cone performed satisfactorily and is suitable for production if needed before standard charges can be made available.
- c. The locally made T-3 Charge with non-annealed cone is not satisfactory and should not be produced.
- d. The locally made T-3 Charge with annealed cone and loaded with composition C-2 is approximately 80 - 85 percent as effective as the standard pentolite-loaded charge.

7. Recommendations:

- a. That T-3 Charges made locally have the cones carefully annealed, in accordance with specifications, and be loaded with Composition C-2 explosive.
 - b. That T-3 Charges be manufactured locally only if required for operational use in advance of receipt of adequate supplies of standard charges.
8. In connection with par 7, b, approximately forty five T-3 Shaped Charges are available for this theater and immediate shipment has been requested. Additional quantities are expected to become available within approximately sixty days.

C. H. M. ROBERTS,
Colonel, Ord. Dept.

Copy for: AC of S, G-4, CPA
Chief of Ordnance, WD

Appendix K

AG 472.91

HEADQUARTERS
FIFTH AIR FORCE
APO 925

AG SECRET
AUTH _____
INIT _____
DATE (about 15 June)

SUBJECT: Estimate of Requirements for 4.5 Inch Rockets and Rocket Launchers.

TO : Commanding General, USAFFE, APO 501.

1. Reference War Department Radio W-35562, dated 18 May 1944, recommended reply for Air Force requirements is as follows:

Air Force requirements for Rocket, HE, 4.5", M8 (T22), are 13,824, per month based on 384 planes, 6 rockets per plane, 6 missions per month.

Air Force requirements for Launcher, Rocket, 3 Tube, M10 (T30), are 576 launchers per month for B-25, and 960 launchers per month for A-20, or a total of 1536 launchers per month both types. These requirements based upon equipping 8 squadrons B-25 and 12 squadrons A-20 as follows: 144 B-25 and 240 A-20 aircraft, 2 launchers per plane and 2 replacements of launchers per month. Replacement based on 6 missions per month and estimated life of 3 missions per launcher, taking into consideration jettisoning of launchers in combat. No rockets or launchers are being requested for fighters.

Estimate that requirements for June and July will be one-half the above quantities for each month. Requirements for August through December will be on full monthly basis as given above.

For the Commanding General:

/s/ O. C. Van Hoesen
O. C. VAN HOESEN,
Lt. Col. AGD
Adj. Gen.

SECRET

HQ XIII FIGHTER COMMAND
OFFICE OF THE ORDNANCE OFFICER
APO 719 Unit I

Ord/RTW/wmr

May 12, 1944

SUBJECT: Demonstration firing of 4.5" Rocket, MB.

TO : Ordnance Officer XIII Fighter Command.

1. The following is a summary of the rocket demonstration staged at Kulambangra May 11, 1944 to test the effectiveness of the 4.5" Rocket, MB, against Japanese anti aircraft gun positions. The target selected was a Japanese 40 m/m AA gun in a circular double walled revetment located on a slight hill. The ground diameter of the inside revetment was approximately 8 feet, walls of the revetment 5-7 feet high, and were of a clay soil covered with sod. Two P-38-J15's, piloted by Major Bolster and Lt. Wearts, each flew three missions and fired 18 rounds at the target; 36 rounds total were fired. The first plane was wired to fire the rockets in pairs, one round from under each wing; the second plane fired singly. On the third mission both ships fired "salvo" (6 rounds in one pass); the first ship firing 3 pairs in 0.6 seconds, the second ship firing 6 single rounds in 0.6 seconds. The rocket tubes of both ships were boresighted for 800 yards range and 300 miles per hour. All rounds were fired from an angle of dive of approximately 20-35 degrees. The fuzes of all rounds were set for .015 second delay.

2. Inspection of the target area on completion of firing revealed one hit within the second wall of the revetment, one hit between the two walls of the revetment, about 5 hits within 30-35 feet of the outer wall, another 5 hits within 75-80 feet of the outer wall, the remaining hits between 80 and 300 feet of the target.

3. It is believed the hit within the second wall would have put the gun out of commission temporarily, but not permanently, due to fragments striking parts of the gun and injury to personnel. This round apparently penetrated the revetment wall and then burst within a few inches of the revetment floor. It is not believed the hit between the two walls would have damaged the gun but only have caused injury to personnel seeking shelter at this point. Damage caused by the remainder of the bursts would be due primarily to flying fragments.

4. All rounds functioned properly (no duds) and no difficulty was experienced with the firing tubes. Crater sizes ranged from 2-6 feet deep and 5-10 feet in diameter, depending upon the angle of impact of the round. Several rounds, striking at a low angle of impact or ricocheting from a stump or knoll, dug furrows 4-8 feet long and about 6 inches deep then burst digging a shallow crater. Rather large fragments of the rocket body were picked up from some of the craters, none of the smaller fragments of the rocket head were seen.

5. It is believed the observers present were favorably impressed with the accuracy of fire and the effectiveness of the rocket bursts. Against this type of target, it is believed the round would be more damaging by setting the fuze to Superquick rather than Delay; this would reduce the number of fragments buried in the crater. For demonstration purposes however, the Delay setting facilitates locating of the hits and judging the effectiveness of detonation of the explosive charge.

RICHARD T. WISE
Capt., Ord. Dept.

DECLASSIFIED

Authority 735001

Appendix M

C O N F I D E N T I A L

HEADQUARTERS CENTRAL PACIFIC AREA

P R O G R A M

. DEMONSTRATION

OF

NEWLY DEVELOPED EQUIPMENT
SUITABLE FOR
BEACH ASSAULT AND RELATED OPERATIONS

MARCH 28 AND 29, 1944

CONFIDENTIAL

~~C O N F I D E N T I A L~~

SCHEDULE OF DEMONSTRATION

I STATIC DISPLAY

Place: Schofield

Date: March 28, 1944

Time: 0930

II CLEARANCE OF BEACH AND UNDERWATER OBSTACLES

Place: Puuiki

Date: March 28, 1944

Time: 1330

III TECHNICAL MOVING PICTURES

Place: Schofield Barracks

Date: March 29, 1944

Time: 1000

IV FIRING OF ROCKETS AND OTHER WEAPONS AGAINST RESISTANT TARGETS

Place: Makua

Date: March 29, 1944

Time: 1330

~~C O N F I D E N T I A L~~

~~C O N F I D E N T I A L~~

I STATIC DISPLAY

Group A: Additional equipment related to Borden Mission

1. Adapter, Grenade, Projection T2
2. Grenade, Rifle, Smoke, Colored Trailing T12
(Yellow, Red, Violet and Green)
3. Flare, Trip, M48
4. Flare, Trip, M49
5. Bayonet, Carbine T4
6. Bayonet, Carbine T6
7. Bayonet, carbine, T8
8. Bayonet, Rifle, M1 and Scabbard, M7
9. Fastener, Strap, Quick Release for Helmet
10. Mortar, 81 m/m, T27 (24" tube)
11. Shell, 60 m/m, HE, M49, with Adapter Projection, Grenade M1
12. Shell, Illum, 60 m/m, M83
13. Paint, Face, Camouflage
14. Kit, Sign, Reproduction and Sign Chest.
15. Lamp, Electric Portable, Command Lost.
16. Water Purification Unit, Pack, Diatomaceous Silica,
3 to 6 GPM Hand and Gasoline Driven.
17. Track extension for Medium Tank (Duckbills)
18. Mask, Gas, Assault Service
19. Bulldozer, Tank Mounting for M-4 Series Tanks

Group B: Mines & Mine Detection Equipment

1. Mine, Antipersonnel, M2A3
2. Mine, Antitank, Non-metallic M5 with Fuze, Chemical M5
3. Mine, Light, Antitank T7 with, Fuze, T9
4. Mine, Heavy, Antitank, T6E1 with Fuze, T8E1
5. Probe, Mine, M1
6. Detector, Antitank Mine, Portable, SCR 625
7. Detector, Antitank Mine, Portable, Non-metallic,
AN/PRS-1. ("Dinah")
8. Marker, Luminous -- Radioactive type 1, 1" Clip Back

~~C O N F I D E N T I A L~~

9. Marker, Luminous -- Radioactive type 2, 1 3/4" Bolt Back
10. Snake, Demolition M2

Group C: Wire Obstacle Equipment

1. Concertina, Wire, Barbed, Roll
2. Cutter, (two to three pound) Wire, Heavy Duty, 9"
3. Bangalore, Mortar Projected, 81 m/m, T1
4. Grapnel, Mortar Projected, 81 m/m T1, with Rack and Cable T1

Group D: Marine Equipment

1. Boat, Landing, Pneumatic Rubber (10 man)
2. Kit for mounting 105 m/m Howitzer on DUKW
3. Flashlight, Waterproof (Navy)

Group E: Concrete Piercing Fuzes

1. Fuze, Nose, CP, T105

Group F: Demolition equipment and firing devices

1. Concussion Detonator
2. Adapter, Priming, Explosive M1A1
3. Explosive, shaped charge, M2A1
4. Explosive, shaped charge, T3
5. Firing Device, Pressure Type, M1
6. Firing Device, Pull Type, M1
7. Firing Device, Pull Type, Friction T2
8. Firing Device, Pull Release Type M3
9. Lighter, Fuze, Weatherproof M2
10. Detonator, Radio
11. Primacord Net, 3 Ft. x 100 ft. 1/6"/ft.
12. Charge, Demolition, Mark 13, Navy (Reddy Fox)
13. Detonator, Delay, 15 second, M1
14. Demolition Equipment, Set No. 5, Individual
15. Demolition Equipment, Set No. 7, Electrical
16. Block, Demolition, M1 (Chain) (Tetrytal)
17. Block, Demolition M2 (Tetrytal)

18. Block, Demolition M3 (C2 Plastic)

19. Crimper, Cap, w/fuze cutter, M2

Group G: Rockets and Rocket Launchers

1. Rocket, 2.36", HEAT, M6A1
2. Rocket, 2.36", HEAT, M6A3
3. Rocket, 2.36", HEAT, T12
4. Rocket, 2.36", Smoke, WP, T26
5. Rocket, 2.36", Smoke, HC, T27
6. Rocket, HE, 4.5" M8
7. Rocket, Practice, 4.5" M9
8. Rocket, HE, 4.5" BR (Navy)
9. Rocket, HE, 4.5" T29
10. Rocket, HE, 7.2", T37
11. Rocket, HE, 8" T25
12. Fuze, Rocket, M4A1 (.015 sec delay)
13. Fuze, Rocket, M4A2 (0.1 sec delay)
14. Fuze, Rocket, Mk137 (Navy)
15. Launcher, Rocket, 2.36", M9
16. Launcher, Rocket, Artillery, 4.5" T35E1 (single tube)
17. Launcher, Rocket, Multiple Artillery 4.5", T27 (8-Tube)
(on Ground)
18. Launcher, Rocket, Multiple Artillery, 4.5", T27
(8-tube) (mounted on LVT)
19. Launcher, Rocket, 4 $\frac{1}{2}$ ", BR Mk IV (single rail) Navy
20. Launcher, Rocket, 4 $\frac{1}{2}$ " BR Mk II MOD I (3 rail) Navy
21. Launcher, Rocket, 4 $\frac{1}{2}$ " BR Mk VIII (12 rail) Navy
22. Launcher, Rocket, 4 $\frac{1}{2}$ " BR Mk VII (automatic 12) Navy
23. Launcher, Rocket, Aircraft, 4.5" T30 (3 tube) (mounted
on P47 Plane)
24. Launcher, Rocket, 8"
25. Launcher, Rocket, Multiple Artillery 7.2" T40 (20 rail)
(mounted on Medium Tank M4 Turret.) (Jettisonable)
26. Launcher, Rocket, Multiple Artillery 4.5" T34 (60 tube)
(mounted on Medium Tank M4 Turret.) (Jettisonable)

II CLEARANCE OF BEACH & UNDERWATER OBSTACLES

1. Lighter Fuze, Weatherproof, M2
Assembled to charge and fired under water.
2. Concussion Detonator
Fired in air and water.
3. Aquatic Snake
Fired under water against obstacles
4. Mortar - projected Bangalore
Fired against barbed wire.
5. Mortar - projected Grapnel
Fired over barbed wire.
6. Concertina (Dannert Roll)
Demonstrate erection of obstacle.
7. 15-Second Delay Detonator
Fired in Bangalore Torpedo
8. Shaped Charge and Priming Adapter
Fired against concrete wall.
9. M1 Tetrytol Pack Charges
Demonstrate multiple firing against concrete obstacles.
10. Wall Charge
Demonstrate breaching of wall.
Passage by Medium Tank.
11. Rubber Boat Passage of Barbed Wire
12. Chicken-wire Frame Passage of Barbed Wire
13. Medium Tank Dozer
Demonstrate passage of obstacles and destruction of
Jap type bunker

III TECHNICAL MOVING PICTURES

1. Passage of Beach and Underwater Obstacles
2. Light Tank Dozer
3. Land Snake
4. Launcher, Rocket, $4\frac{1}{2}$ " BR T44 (120 rail for DUKW)
5. Firing of Artillery Tanks and self-propelled mounts
from landing craft.
6. Marshall Islands Operations

IV FIRING OF ROCKETS AND OTHER WEAPONS AGAINST RESISTANT TARGETS

1. Launcher, Rocket, $4\frac{1}{2}$ " T35E1
Fire 5 rockets at Jap-type bunker
(Fuzes 0.1 sec delay)

2. Fuze, Nose, CP T105
Fire 155 m/m standard HE Shell from 155 m/m Gun M1
against concrete wall 8 ft high and 8 ft thick.
3. Adapter, Grenade, Projection T2
Fire assorted Grenades, Hand, Smoke Colored, M16;
Grenade, Hand, Smoke, HC, M8; and Grenade, Hand,
Incendiary M14 from M1 Rifle with M7 Launcher.
4. Grenade, Rifle, Smoke, Colored, Trailing T12
Fire yellow, red, violet from M1 rifle with M7 launcher
5. Shell, 60 m/m HE, M19 with Adapter, Projection Grenade M1
Fire 2 rounds from M1 rifle with M7 launcher and
cartridge Auxiliary M7
6. Flare, Trip M48
Fire one round
7. Flare, Trip M49
Fire one round
8. Shell, Illuminating, 60 m/m M83
Fire 3 rounds
9. Mortar, 81 m/m T27
Fire 2 rounds each M43, M56, M57
10. Launcher, Rocket, AT, 2.36" M9
Fire the following:
 - a. Rocket, 2.36" HEAT M6A1
 - b. Rocket, 2.36" HEAT M6A3
 - c. Rocket, 2.36" HEAT T12
 - d. Rocket, 2.36" Smoke WP T26
 - e. Rocket, 2.36" Smoke HC T27
11. Launcher, Rocket, 4.2" BR Mk IV (single rail) (NAVY)
Fire 5 rounds rapid fire at Jap-type bunker
12. Launcher, Rocket, 4.2" BR Mk II Mod I (3 rail) (NAVY)
Fire 2 salvos at Jap-type bunker
13. Launcher, Rocket, 4.2" BR Mk VIII (12 rail) (NAVY)
Fire one pair in ripple
14. Launcher, Rocket, 4.2" BR Mk VII (12 round Automatic) (NAVY)
Fire one pair automatically.
15. Kit for Mounting 105 m/m Howitzer on DUKW
Fire 5 rounds with M18A1 fuze, from 105 m/m Howitzer M2A1
lashed to DUKW.
16. Medium Tank M4 in LCM6. (Hinged Ramp)
Fire 5 rounds with M18A1 fuze from 75 m/m turret gun.
17. 3" Gun Motor Carriage M10 in LCM6
Fire 5 rounds with M18A1 fuze from 3" gun.
18. Launcher, Rocket, Multiple Artillery, 4.5" T27 mounted on
LVT
Fire 2 ripple salvos of 8 rockets each with fuzes set
60% delay and 40% instantaneous.

19. LCT equipped with 12 4.2" Mortar
Fire 10 rounds HE per Mortar against shore targets.
20. Launcher, Rocket, Aircraft $4\frac{1}{2}$ " T30 (3 tubes)
Fire one ripple salvo at water target and one ripple salvo at shore target. (Fuzes set .015 sec delay.)
21. Launcher, Rocket, Multiple, Artillery $4\frac{1}{2}$ " T27
Fire three ripple salvos of 8 each. (Fuzes set 60% delay (0.1 sec) and 40% instantaneous.)
Fire 2 rounds to sea at maximum range for comparison with 2 rounds $4\frac{1}{2}$ " BR Rocket
22. Rocket, HE, $4\frac{1}{2}$ " T29
Fire 2 rounds with airburst fuze from T27 Launcher.
23. Launcher, Rocket, 8"
Fire 4 rounds at shore targets.
24. Launcher, Rocket, Multiple, Artillery, 7.2" T40 (20 rail)
Fire slow ripple at short range at concrete wall - 8 ft high and 6 ft thick.
25. Launcher, Rocket, Multiple, Artillery, 4.5" T34 (60 tube)
Fire at shore targets (Fuzes set 60% delay (0.1 sec) and 40% instantaneous.)

Sample Page of Questionnaires Used at Demonstrations.

1. Adapter, Grenade, Projection T2

a. Do you consider this item suitable for operational use:

(1) In general? Yes _____ No _____

(2) In this area? Yes _____ No _____

b. Is this item needed (a) in addition to (), or (b) as a substitute for (), a standard item now in use? (Place check mark after statement you believe applicable.) If (b), what standard item should it be substituted for?

c. Comments (including any suggested modification or improvement).

2. Grenade, Rifle, Smoke, Colored Trailing T12 (Yellow, Red, Violet, and Green).

a. Do you consider this item suitable for operational use:

(1) In general? Yes _____ No _____

(2) In this area? YES _____ No _____

b. Is this item needed (a) in addition to (), or (b) as a substitute for (), a standard item now in use? (Place check mark after statement you believe applicable.) If (b), what standard item should it be substituted for?

c. Comments (including any suggested modification or improvement).

3. Flare, Trip, M48

a. Do you consider this item suitable for operational use:

(1) In general? Yes _____ No _____

(2) In this area? Yes _____ No _____

b. Is this item needed (a) in addition to (), or (b) as a substitute for (), a standard item now in use? (Place check mark after statement you believe applicable.) If (b), what standard item should it be substituted for?

c. Comments (including any suggested modification or improvement).

REQUISITIONS FOR MATERIEL ON ROBERTS MISSION
"ROS"

ITEM	CPA	SPA	SWPA
<u>ORDNANCE DEPARTMENT</u>			
Grenade, Smoke, Colored, Trailing T12 (1/3 ea. yellow, red, violet	15,000	10,000	72,000
Fuze, nose, C.P. T105	65,600 (e)	25,000	
Grenade, Mine, A.T., T7		5,000	
Mine, Non-Metallic, A.T., M5		5,000	
Mortar, 81 mm T27, with packboard	200	36	100
Bayonet-Knife, (T8) M4*	101,844	40,000	
Release, Chin Strap, T1		25,000	849,969
Rocket, Smoke, W.P., 2.36" T26			54,400
Rocket, H.E., 4.5" M8, with fuze, Rocket M4A2	34,000	18,000	24,000
Rocket, Practice 4.5" M9 with fuze, Dummy, M6	1,000	4,000	2,400
Rocket, H.E., 4.5" Navy (BR)	(f)	6,000	(f)
Rocket, H.E., 7.2" T37, compl. with fuze MK 146	10,000	5,000	10,000
Rocket, H.E., 8" T25, with fuze, Rocket, T20	50	200	
Flare, Trip M49	24,000 (a)		12,000
Flare, Trip M48	9,600 (b)		12,000
Launcher, Rocket, 4.5" (T35E1) M12, complete with M4A2 fuze and Packboard	3,500		
Launcher, Rocket, 4.5" T34	50	5	50
Launcher, Rocket, 4.5" T27	50	15	
Launcher, Rocket, 7.2" T40	50	12	50
Launcher, Rocket, 8", T___	50	4	
Connector, Extended end, for M4 Tank	81,965	34,000	37,000
Harness T1 (for mounting 105 mm on DUKW)	108	36	36
Launcher, Rocket, 4.5" BR Mk VII (Navy)		5	300
Kit, Waterproofing, for 105 mm How. M2A1			1,500
Tracer, Headlight, Cal. .50	10,000 (c)		

ET

ITEM	CPA	SPA	SWPA
Launcher, Rocket, 4.5" BR, T44 for DUKW and LVT	60 (f)		12 (f)
76 MM Gun Motor Carriage T70	44		
Medium Tank T23	6		
Shell, H.E., M42, 76 MM	33,480		
Shell, H.E., M42, 76 MM, Reduced Charge	9,360		
Projectile, A.P.C., M62A1, 76 MM	17,280		
Shell, W.P., 76 MM M88 w/Fuze P.D. M57	5,040		
Truck, Flatbed, 4 Ton 6 x 6, 4dt W/"A" frame	4		
Device, Traction, Galanot Watson, Sets	500		
CORPS OF ENGINEERS			
Propelling Unit, Barge, Outboard Type, 40 HP	20		100 (d)
Conveyor, Power, 24", Flat Belt, .50 ft., Set Compl.	1		
Machine, Rehabilitation Plant, Roller Type	1		
Motor, Storm, Airplane Type, w/18 ft. Seasled	5		
Cab, Motor Grader, Armored	20		
Water Purification Unit, Pack, 3-6 GPM	50	12	35
Stake, Delineator, w/reflector	400		
Detonator, Concussion	1,000	2,000	2,000
Lighter, Fuze, Weatherproof, M2	76,000	10,000	100,000
Kit, Sign Reproduction and Sign Chest	39	24	130
Boat, Recon, Pneumatic, Canvas, 2 man	300	50	
Outfit, Diving, Set No. 3	30		
Marker, Luminous, Radioactive, Type I	6,000		7,000
Marker, Luminous, Radioactive, Type II	6,000		7,000
Mine, Probe M1	900		
Equipment, Metallizing, Set No. 1	40	6	60
Shower, Unit, 8 Head	15	50	
Kit, Water analysis, Portable	18		
Device, Firing T2 (M2)	125,000	10,000	10,000
Device, Firing M3	2,500	2,000	5,000

SECRET

ITEM	CPA	SPA	SWPA
Adapter, Priming M1A1		20,000	100,000
Block, Demolition, M1			150,000
Block, Demolition, M2		10,000	150,000
Block, Demolition, M3		10,000	150,000
Explosive, Shaped Charge M2A1		300	
Explosive, Shaped Charge T3		300	1,000
Concertina, Wire, Barbed, roll		10,000	
Boat, Landing (10 Man)			90
Charge, Demolition, Mk 13 Navy, (Reddy Fox), with fuze, Demolition T1			50
Detonator, Delay, 15 second			100,000
Bulldozer, Tank Mounting, for M4 Tank			40
Pipeline Equipment Set for 2½ Ton Truck***	25		12
Trailer, 4-Wheel, 7-14 Ton, 4 DT w/Truck 4 Ton 6 x 6 ***	10		20
Tractor, Crawler, Diesel 70-90 DBHP***	15		
Winch, Tractor Mtg. Double Drum w/Gipy Spool	12		20
Odograph, Land, 6-volt, Jeep mounted	25		
Tractor, Beach Attachments for D-7	36	3	
Pile driving Rig, Steel, Skid Mtd., 55 ft. lead***	2	3	
Sawmill, light, Portable, Gasoline	6		

CHEMICAL WARFARE SERVICE

Generator, Smoke, Mechanical, M2	12		
Mask, Gas, Assault Service	*	10,000	200,979
Mount, 4.2" Chemical Mortar, LC-E2R2	2 (c)		4

SIGNAL CORPS

Lamp, Electric, Portable, Command Post	25	50	
Flashlight, Navy Type, Waterproof			7,500
Detector, Anti-Tank Mine, Portable, Non-Metallic Mine, AN/PRS-1 (Dinah)	30		

SECRET

ITEM

CPA

SPA

SWPA

QUARTERMASTER CORPS

Paint, Face, Camouflage

10,000

Cutter, (2 to 3 pounds), Wire, Heavy Duty, 9"

500

FOOTNOTES

- a. Plus 9,405 on Ord. Req. #W319-44
- b. Plus 1,896 on Ord. Req. #W319-44
- c. By Radio 24 March
- d. By radio 6 May, Trans. Corps. Req. #B-148
- e. Incl. 5000 by radio
- f. Handled by direct War Dept. action, about 29 March
- * Normal Supply
- ** To be supplied as controlled item.
- *** Must be submitted as project item.

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APPENDIX O

EXTRACT OF RADIO TO WAR DEPARTMENT FROM CPA DATED 31 MARCH 1944

"PETER FOUR SEVEN FIRING ON WATER TARGET EXCELLENT, BUT FIRING ON LAND TARGET PREVENTED BY RUPTURE OF TWO TUBES. DAMAGE TO PLANE VERY SLIGHT. NO EVIDENCE OF MOTOR FAILURE AND ROCKET FLIGHT NORMAL. CLUSTERS NUMBERS 2654 AND 2659, APPARENTLY SPLICED TUBES AND BOTH RUPTURES OCCURRED AT SPLICES. COMPLETE REPORT BEING MADE BY SEVENTH AAF ORDNANCE OFFICER."

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FIGURES AND PHOTOGRAPHS

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- Photo No. 2 Japanese flamethrower, cartridge-ignition type, found at Los Negros Isl.
- Photo No. 3 Japanese log bunker, built under large tree on shore of Los Negros Isl.
- Photo No. 4 Heavy Japanese log bunker near shore of Los Negros Isl. Note embrasure at ground level.
- Photo No. 5 Japanese log bunker on shore of cove at Los Negros Isl.
- Photo No. 6 Unrevetted Japanese trench with uncamouflaged spoil, probably of recent construction. Los Negros Isl.
- Photo No. 7 Typical shallow zigzag Japanese trench on Los Negros Isl. Trenches were few and intermittent.
- Photo No. 8 Japanese 4.724" anti-boat gun on shore of Los Negros Isl. Note low earthen parapet.
- Photo No. 9 Japanese 4.724" anti-boat gun near airstrip at Los Negros Isl.
- Photo No. 10 Japanese 48" searchlight, with shutters for signalling, located under trees near shore at Los Negros Isl.
- Photo No. 11 Runway extension under construction at Momote Field, Los Negros Isl. Note height of trees in rain forest in background.
- Photo No. 12 Typical Japanese earthen plane revetment at field on Wakde Isl.
- Photo No. 13 Coconut log and earth fill plane revetment on Wakde Isl., in use for storing U. S. bombs.
- Photo No. 14 Strongest coconut log shelter found on Wakde Isl. Roof was three layers of 12" logs, covered with dirt.
- Photo No. 15 Underground log shelter with roof of one layer of logs on Wakde Isl. Note complete concealment by vegetation.
- Photo No. 16 Part of village on Wakde Isl., destroyed by artillery fire. Note light construction.
- Photo No. 17 Effects of preparatory bombardment on coconut grove, Wakde Isl. Note Jap water tank in distance.
- Photo No. 18 Destroyed Jap plane and effects of preparatory bombardment, Wakde Isl.
- Photo No. 19 Concrete septic tank on Wakde Isl. Used for Ammunition storage. Walls 24" thick, poor quality concrete, roof originally wood. This was only type of concrete structure on the island.
- Photo No. 20 Entrance to cave in coral cliffs on north shore of Wakde Isl. Cliffs within 30-40 yards of waterline at low tide.

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FIGURES AND PHOTOGRAPHS

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- Photo No. 29 Box with hand pumps, heaters and accessories for large water purification unit. (cf. No. 27).
- Photo No. 30 Japanese silk-screen reproduction set, found at Eniwetok Atoll.
- Photo No. 31 Japanese "Surrender Pass", dropped from enemy planes in New Guinea. (Front view).
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- Photo No. 33 Effect of T3 shaped charge with non-annealed cone, on 6-foot concrete wall. (Branched hole 32" deep). Puu Iki, Oahu, 28 March 1944.
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- Photo No. 36 CPA Demonstration, 28-29 March 1944. General view of static display at Schofield Barracks, 28 March 1944.
- Photo No. 37 CPA Demonstration, 28-29 March 1944. 4.5" and 7.2" rocket launchers on M4 tanks, in static display.
- Photo No. 38 CPA Demonstration, 28-29 March 1944. 105 mm howitzer on DUKW, in static display.
- Photo No. 39 CPA Demonstration, 28-29 March 1944. P47 plane with 4.5" rocket launchers, in static display.

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FIGURES AND PHOTOGRAPHS

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- Photo No. 41 CPA Demonstration, 28-29 March 1944. Tank dozer removing concrete obstacles at demonstration, Puu Iki, Oahu, 28 March.
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- Photo No. 45 SWPA Demonstration, 24 May 1944. Observers at static display, Finschhaven .
- Photo No. 46 SWPA Demonstration, 24 May 1944. Observers examining small equipment at static display, Finschhaven.
- Photo No. 47 SWPA Demonstration, 24 May 1944. Part of hillside target area after firing demonstration, showing effects of 105 mm H.E. with T105 fuze on bunker at left, and effects of 4.5" rockets on bunker at right. Finschhaven.
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- Photo No. 49 CPA Demonstration, 28-29 March 1944. Effect of T35 Jungle rockets on log bunker at Makua, Oahu, 29 March.
- Photo No. 50 SWPA Demonstration, 18-19 May 1944. Destruction of log bunker (seven feet thick) by seven 7.2" rockets in demonstration at Milne Bay, 19 May.
- Photo No. 51 SWPA Demonstration, 24 May 1944. Destruction of log bunker (seven feet thick) by seven 7.2" rockets in demonstration at Finschhaven.
- Photo No. 52 CPA Demonstration, 28-29 March 1944. Effect of fourteen 7.2" rockets on heavily reinforced 6-foot by 8-foot concrete wall at Makua, Oahu, 29 March.
- Photo No. 53 CPA Demonstration, 28-29 March 1944. Effect of three 155 mm H.E. with T105 fuze on heavily reinforced concrete wall, 8 feet high and 8 feet thick at Makua, Oahu, 29 March.
- Photo No. 54 SPA Demonstration, 6-7 May 1944. Effect of three 75 mm H.E. with T105 fuze on 6-foot by 8-foot reinforced concrete wall at Guadalcanal, 7 May. (Complete penetrations at left and right, center hit burst in wall).
- Photo No. 55 SPA Demonstration, 6-7 May 1944. Tank gap blown in 6-foot by 8-foot reinforced concrete wall with 1200 lb. hand placed tetrytol charge, Guadalcanal, 7 May. (Note shallow crater).
- Photo No. 56 SPA Demonstration, 28-29 April 1944. 1512 lb. tetrytol charge in position against 6-foot by 8-foot backfilled reinforced concrete wall at Mbo Island, Noumea, 29 April.

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FIGURES AND PHOTOGRAPHS

- Photo No. 57 SPA Demonstration, 28-29 April 1944. Tank gap blown in concrete wall by charge shown in photo No. 56. (Front view showing shallow crater in foreground).
- Photo No. 58 SPA Demonstration, 28-29 April 1944. Rear view of tank gap shown in photo No. 57, showing removal of sand backfill. (Coast of New Caledonia in background).
- Photo No. 59 CPA Demonstration, 28-29 March 1944. Medium tank with dozer destroying log bunker at demonstration at Puu Iki, Oahu, 28 March. (Note that apertures have been blocked).
- Photo No. 60 Australian Wire Mesh Bridge, at S.M.E., Liverpool, 12 June 1944. Chevrolet Sedan being driven across 150-foot unsupported span.
- Photo No. 61 Australian Mortar-Projected Grapnel, at S.M.E., Liverpool, 12 June 1944. Total weight approximately 30 lbs., range approximately 250 feet, using 1/4" rope.

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Trenches were few and intermittent.



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Note low earthen parapet.



Japanese 4.724" anti-boat gun near airstrip at Los Negros Isl.



Japanese 48" searchlight, with shutters for signalling, located under trees near shore at Los Negros Isl.



Runway extension under construction at Momote Field, Los Negros Isl. Note height of trees in rain forest in background.



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Coconut log and earth fill plane revetment on Wakde Isl., in use for storing U. S. bombs.



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Part of village on Wakde Isl., destroyed by artillery fire. Note light construction.



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Destroyed Jap plane and effects of preparatory bombardment, Wakde Isl.



Concrete septic tank on Wakde Isl. Used for Ammunition storage. Walls 24" thick, poor quality concrete, roof originally wood. This was only type of concrete structure on the island.



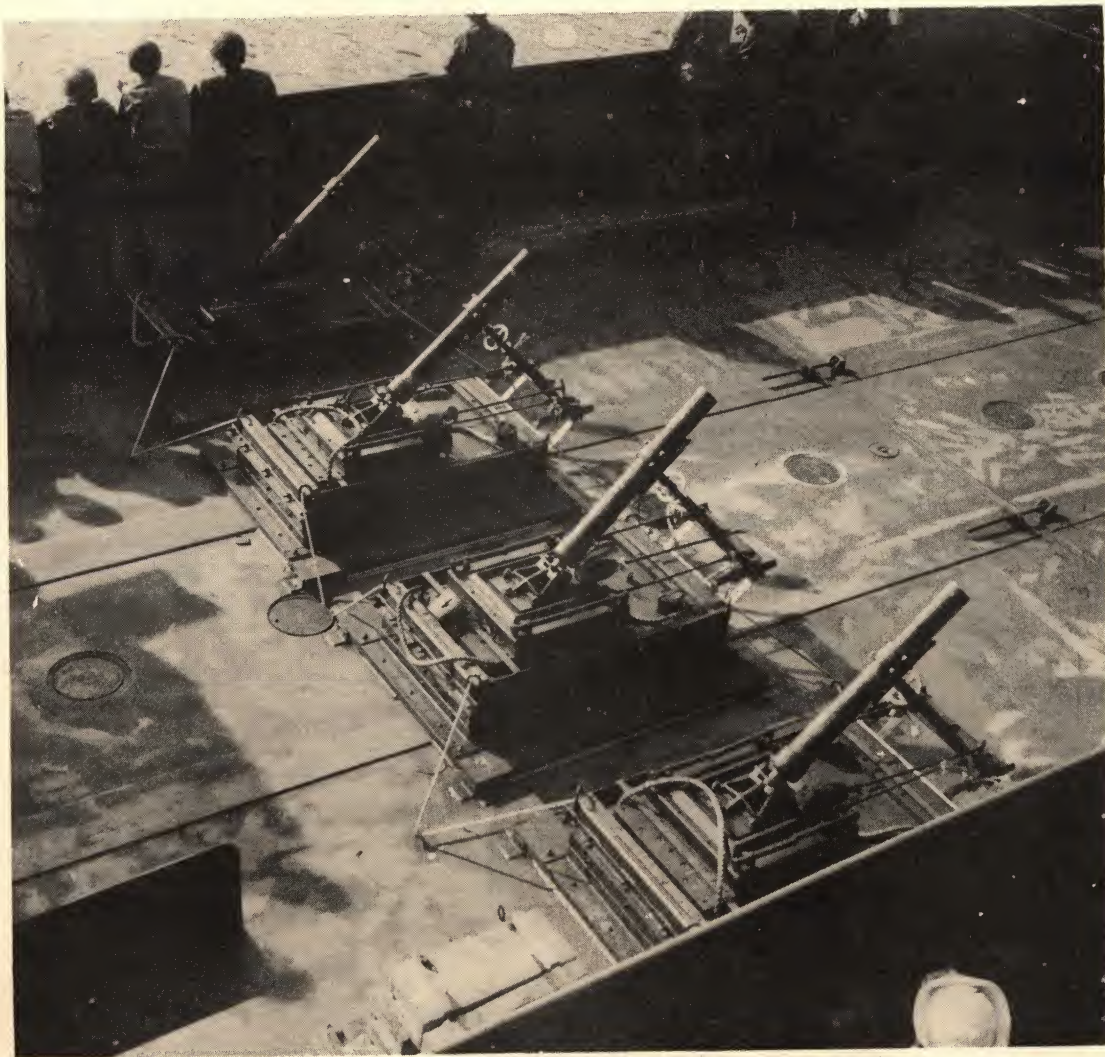
Entrance to cave in coral cliffs on north shore of Wakde Isl. Cliffs within 30-40 yards of waterline at low tide.



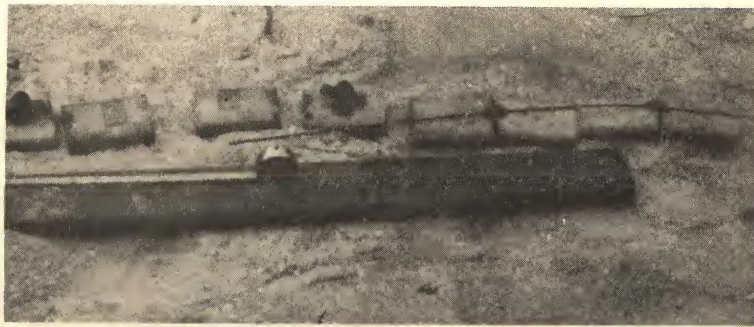
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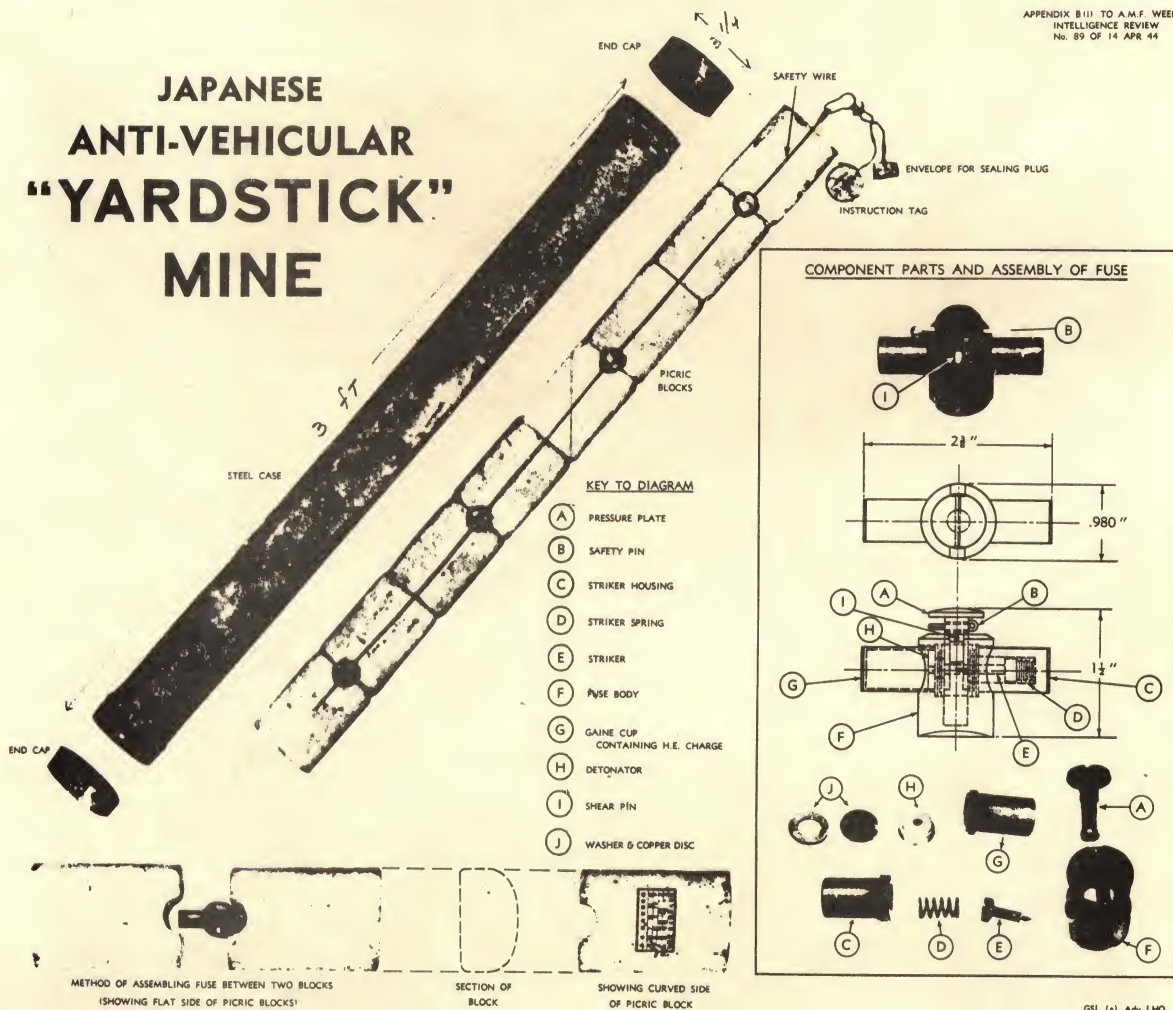
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APPENDIX B(1) TO A.M.F. WEEKLY
INTELLIGENCE REVIEW
No. 89 OF 14 APR 44

JAPANESE ANTI-VEHICULAR "YARDSTICK" MINE



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Six element cylindrical filter unit, with end removed to show rotary cleaning brush. (cf. No. 27).



Box with hand pumps, heaters and accessories for large water purification unit. (cf. No. 27).



Japanese silk-screen reproduction set, found at Eniwetok Atoll.

HERE'S ALL YOU DO !

- 1) Come towards our lines waving white flag !
- 2) Strap your gun over your left shoulder, muzzle down and pointed behind you.
- 3) Show this ticket to the sentry.
- 4) Any number of you may surrender with this one ticket.

JAPANESE ARMY HEADQUARTERS

The Pass
Passes of this card has surrendered,
本票持筆者ハ投降者ニ付保護ヲ加フベシ
so give him protection.
大日本軍司令官
Japanese Army Commander



Japanese "Surrender Pass", dropped from enemy planes in New Guinea. (Front view)

Japanese "Surrender Pass". (Rear view).



Effect of T3 shaped charge with non-annealed cone, on 6-foot concrete wall. (Branched hole 32" deep). Puu Iki, Oahu, 28 March 1944.



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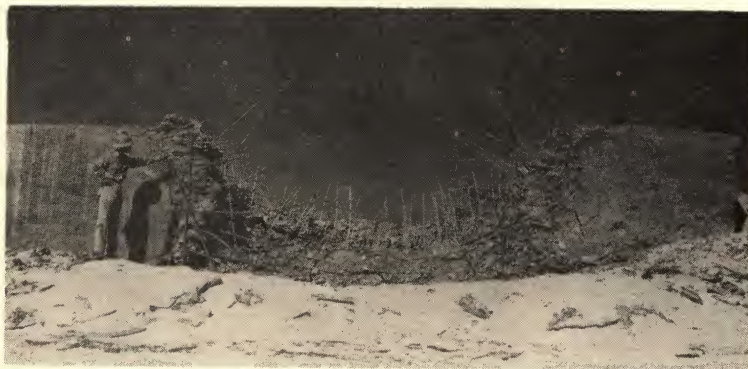
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